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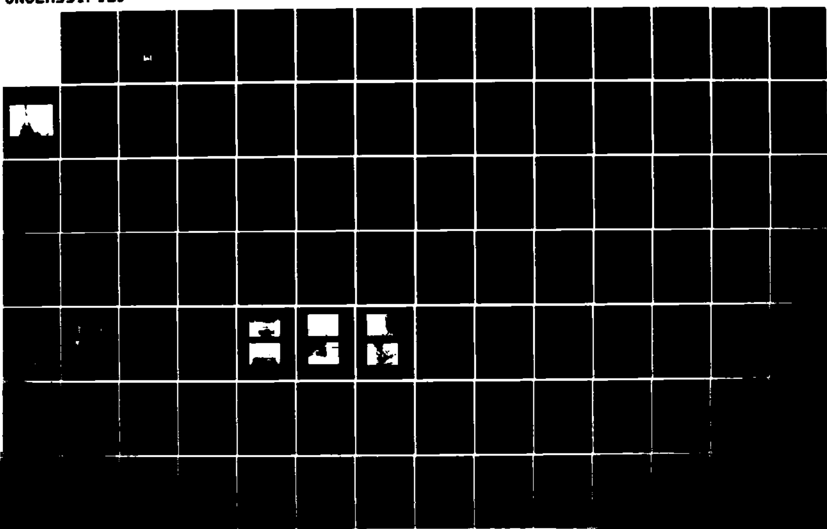

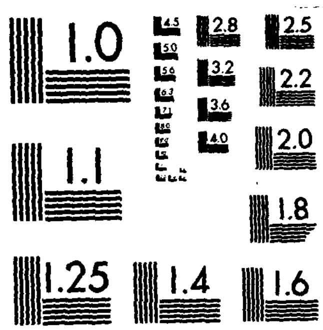

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AD-A156 435

CONNECTICUT RIVER BASIN
WINCHESTER, NEW HAMPSHIRE

KILBURN POND DAM

NH 00298

NHWRB NO. 255.09

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JUNE 1980

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Connecticut River Basin
Winchester, New Hampshire
Kilburn Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

TUe dam is a concrete gravity dam structure consisting of an overflow section and gate house structure and is about 35 ft. long between the ledge abutments. The dam is about 15 ft. high. Because of the lack of a low level functioning outlet, the dam is rated fair. It is small in size with a significant hazard potential. A major breach at top of dam would leave the potential of loss of less than a few lives, as well as economic loss.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

OCT 21 1980

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Kilburn Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Town of Hinsdale, Bard of Water and Sewer Commissioners, Hinsdale, NH.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

KILBURN POND DAM

NH 00298

NHWRB 255.09

CONNECTICUT RIVER BASIN
WINCHESTER, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT
BRIEF ASSESSMENT

Identification No: NH 00298

Name of Dam: Kilburn Pond Dam

Town: Winchester

County and State: Cheshire, New Hampshire

Stream: Kilburn Brook

Date of Inspection: May 6, 1980

Kilburn Pond Dam is a concrete gravity structure consisting of an overflow section and gate house structure and is approximately 35 feet long between the ledge abutments. The dam is approximately 15 feet high from the lowest point of the downstream toe to the top of the overflow section training walls. The overflow section consists of two 13 feet long sections located between concrete training walls. The overflow section is ogee-shaped and has a maximum height of approximately 11 feet from its crest to the bottom of the channel. Located between the left training wall and the left abutment is the gate house structure which encloses the control mechanisms for a 6-inch and an 18-inch diameter sluice gate. These gates open into a gate chamber that outlets through a 24-inch diameter conduit which discharges at the toe of the dam through a flap gate. A service bridge extends across the overflow section from the right abutment to the gate house doorway.

The dam impounds Kilburn Pond and the discharge flows through Kilburn Brook in a southerly direction approximately 3.4 miles to the Ashuelot River. The dam was originally constructed to provide a primary water supply for the town of Hinsdale, but has since been abandoned for that purpose and presently serves only conservational purposes. The pond is 0.68 miles in length with a surface area of about 37 acres. The maximum storage capacity at top of dam is about 461 acre-feet.

As a result of the visual inspection of this facility, the dam is generally considered to be in good condition. The only major concern is lack of a functioning low-level regulating outlet that would allow drawdown of the pond in an emergency. Because of this lack of a functioning low-level outlet, the dam is rated FAIR.

This dam is classified as SMALL in size and a SIGNIFICANT hazard structure in accordance with the recommended guidelines established by the Corps of Engineers. The test flood for this dam, therefore, ranges from the 100-year flood to one-half the Probable Maximum Flood (1/2 PMF). The 1/2 PMF was selected for this

hydrologic analysis. The test flood inflow was estimated to be 1,820 cfs and resulted in a routed test flood outflow equal to 1,320 cfs which would overtop the dam crest by about 0.5 feet. The maximum spillway capacity with the water level at the dam crest was estimated to be 1,020 cfs, which is about 77 percent of the routed test flood outflow. The spillway is capable of passing the routed test flood outflow from a 100-year storm event. An assumed breach with the pond surface at the dam crest would overtop Route 63 located about 1.8 miles downstream by about 2.5 feet and the water would rise to nearly 1 foot above the sill level of the house located near the Route 63 road culvert. The potential for loss of less than a few lives would exist, as well as economic loss.

It is recommended that the owner engage a qualified registered engineer to investigate the source of the debris blocking the low-level outlets and the inoperability of the gate lifting mechanism and design remedial measures to keep these outlets operable; and to inspect the downstream face of the dam and the flap gate once the debris has been removed from the discharge channel. It is also recommended that the owner repair all scaled concrete, repair or replace the gate house door, remove loose rust and repaint the service bridge and other rusted equipment and remove brush and debris from the discharge channel.

The recommendations and remedial measures are described in Section 7 and should be addressed by the owner within one year after receipt of this Phase I Inspection Report.

Kenneth M. Stewart

THE STATE OF NEW HAMPSHIRE
KENNETH M. STEWART NO. 3531
REGISTERED PROFESSIONAL ENGINEER

Kenneth M. Stewart
Project Manager
N.H.P.E. 3531

S E A Consultants Inc.
Rochester, New Hampshire

This Phase I Inspection Report on Kilburn Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and

rarity of such a storm event, finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespassing and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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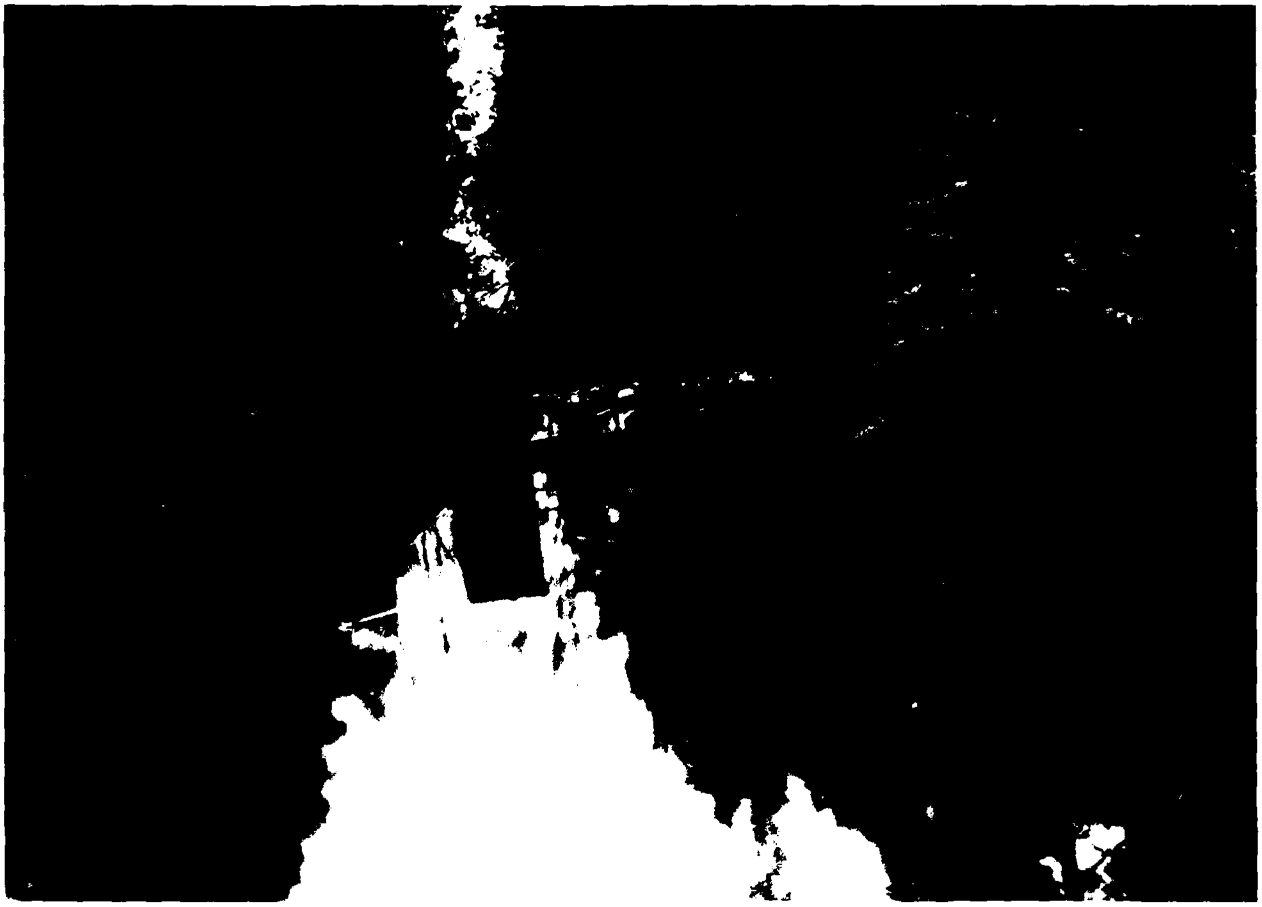
APPENDICES



OVERVIEW PHOTO - KILBURN POND DAM

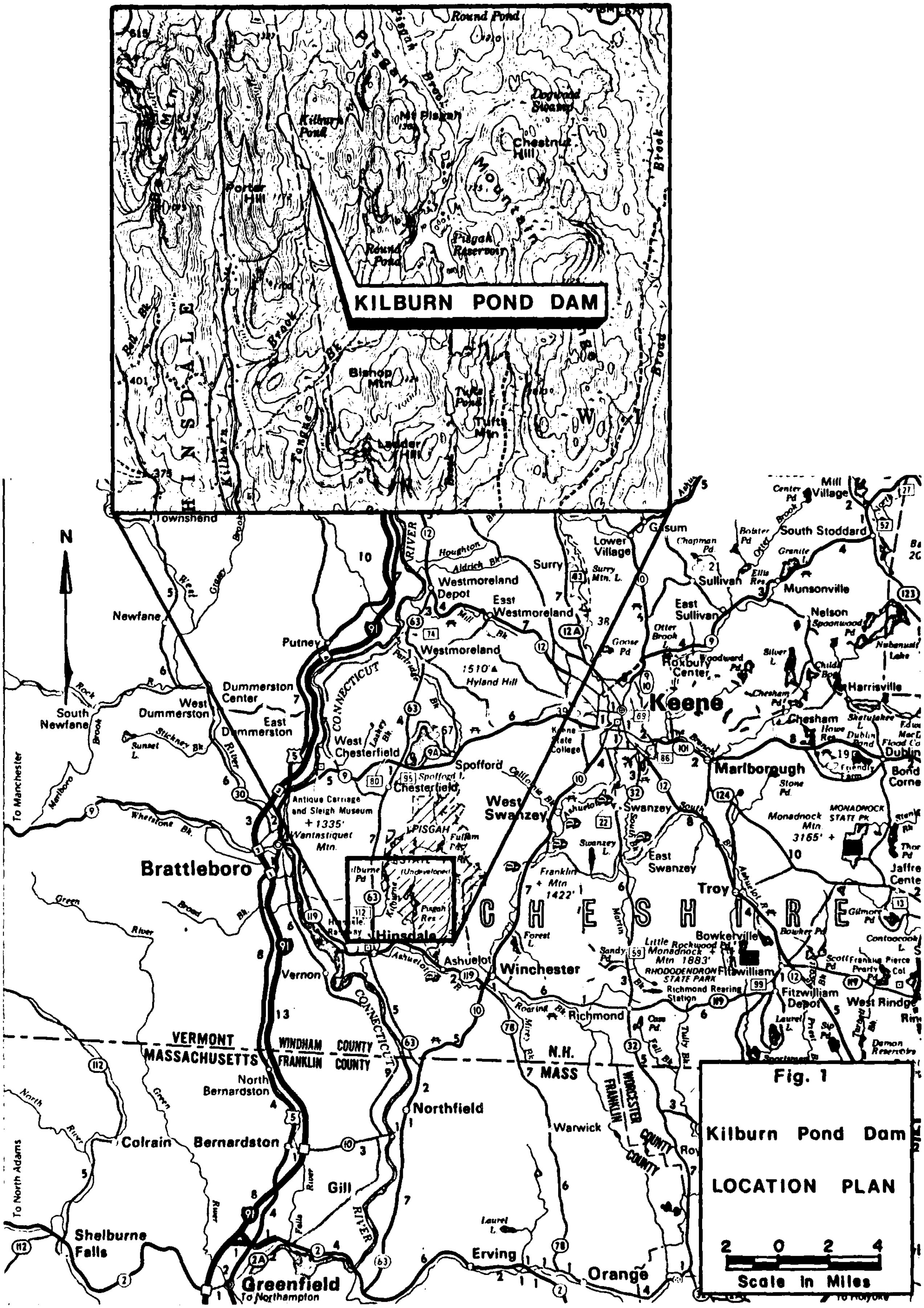


Fig. 1

Kilburn Pond Dam

LOCATION PLAN

2 0 2 4

Scale in Miles

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
KILBURN POND DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. S E A Consultants Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to S E A Consultants Inc. under a letter of November 5, 1979 from William Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0008 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Kilburn Pond Dam is located in the Town of Winchester, New Hampshire, on the south end of Kilburn Pond. The dam impounds water creating Kilburn Pond and the spillway discharge enters Kilburn Brook and flows in a southerly direction approximately 3.4 miles until it converges with the Ashuelot river in the center of Hinsdale, New Hampshire. The dam is shown on U.S.G.S. Quadrangle, Keene, New Hampshire-Vermont, with coordinates approximately at N42°49'50", W72°28'15", Cheshire County, New Hampshire (See Location Plan).

b. Description of Dam and Appurtenances. Kilburn Pond Dam is a concrete gravity structure consisting of an overflow section and gate house structure and is approximately 35 feet long between the ledge abutments. The dam is approximately 15 feet high from the lowest point of the downstream toe to the top of the overflow section training walls. The overflow section consists of two 13 feet long sections located between 4 feet high concrete training walls and is approximately 11 feet high from its crest to channel bottom. The upstream face of the concrete overflow section is battered at 12 feet vertical to 1 foot horizontal (12V:1H). The downstream face is ogee-shaped and is inclined at one foot vertical to one foot horizontal (1V:1H).

The gate house is located between the left training wall of the overflow section and the left abutment and encloses the control mechanisms for a 6 inch and an 18 inch diameter sluice gate. These gates open into a gate chamber that outlets through a 24 inch diameter conduit which discharges at the toe of the dam through a flap gate. A service bridge extends across the overflow section from the right abutment to the gate house doorway.

c. Size Classification. Small (height - 15 feet; storage - 461 acre-feet) based on storage (less than 1000 acre-feet and greater than or equal to 50 acre-feet) as given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Significant Hazard. An assumed breach in the Kilburn Pond Dam would overtop the dam associated with an abandoned filtration plant just upstream from NH Route 63 by about 1.7 feet. NH Route 63 would be overtopped by approximately 2.5 feet, and water would rise to nearly 1 foot above the sill level of the house located near the Route 63 culvert. The state highway could be damaged and the potential for loss of less than a few lives would exist, as well as economic loss.

e. Ownership. The dam was constructed in 1935, apparently to replace an earlier wooden structure at the same site and has been continually owned by the Town of Hinsdale, Board of Water and Sewer Commissioners, Town Hall, Main Street, Hinsdale, New Hampshire 03451, Telephone No. (603) 336-5621.

f. Operator. The dam is maintained and operated by the Town of Hinsdale, Board of Water and Sewer Commissioners, Town Hall, Main Street, Hinsdale, New Hampshire 03451, Telephone No. (603) 336-5621.

g. Purpose of Dam. The dam was originally constructed to provide a primary water supply for the Town of Hinsdale. In 1954, the town began pumping water from two wells, abandoning the Kilburn Pond water supply. At present, the dam serves only conservational purpose.

h. Design and Construction History. The dam was designed by Metcalf and Eddy, Inc., Engineers, of Boston, Massachusetts in 1934. Construction began late in the same year by the O. W. Miller Company, Inc. of Springfield, Massachusetts, and work was completed in 1935. The design plans indicate the concrete dam is reinforced and built on ledge. Design plans and specifications are on file at the State of New Hampshire Water Resources Board. a copy of the record drawings was obtained from Metcalf and Eddy, Inc., Engineers. No in-depth design calculations were available.

i. Normal Operating Procedures. The dam was originally constructed to provide a primary water supply for the Town of Hinsdale, but has since been abandoned for that purpose. As a result of this fact, as well as the fact that the dam is remotely located and can only be reached after a half mile hike or with a four wheel drive vehicle (weather conditions permitting), the dam is rarely examined by the owner. There are no normal operating procedures.

1.3 Pertinent Data

a. Drainage Area. The drainage area above Kilburn Pond Dam covers approximately 1.65 square miles (nearly 1,060 acres), consisting of steeply sloping terrain surrounding Kilburn Pond, as well as Baker Pond and a relatively large swampy area which are located upstream from Kilburn Pond. The topography in the drainage basin ranges from 1,416 feet (NGVD) on top of Davis Hill to 1,029.5 feet (NGVD) at the base of the dam. The drainage basin is heavily wooded and almost completely undeveloped, since it is located almost entirely within Pisgah State Park.

b. Discharge at Damsite. Discharge at the damsite occurs over the two 13 feet long portions of the ogee-shaped overflow section. A 6 inch and an 18 inch diameter sluice gate are located in the gate house structure. The sluice gate openings were blocked at the time of inspection but, when operable, would allow the pond to be lowered to an elevation of 1,031.0 feet.

(1) The capacity of the sluice gates was estimated to be 34 cfs with the water surface at the top of dam (Elev. 1,044.75 feet) and 35 cfs with the water surface at the test flood elevation (Elev. 1,045.2 feet).

(2) Maximum known flood at damsite - unknown

(3) The ungated spillway capacity with the water surface at the top of the dam (Elev. 1,044.75 feet) was estimated to be 1,020 cfs.

(4) The ungated spillway capacity with the water surface at the test flood elevation (Elev. 1,045.2 feet) was estimated to be 1,190 cfs.

(5) Gated spillway capacity at normal pool elevation - N/A

(6) Gated spillway capacity at test flood elevation - N/A

(7) The total spillway capacity at the test flood elevation (Elev. 1,045.2 feet) was estimated to be 1,190 cfs.

(8) The total project discharge at the top of the dam (Elev. 1,044.75 feet) was estimated to be 1,075 cfs (with the sluice gates closed) and 1,110 cfs (with the sluice gates open).

(9) The total project discharge at the test flood elevation (Elev. 1,045.2 feet) was estimated to be 1,320 cfs.

c. Elevation (feet, NGVD). These elevations are based on datum information from design plans obtained from Metcalf and Eddy, Inc., Engineers, Boston, Massachusetts.

(1) Streambed at toe of dam - 1,029.5

(2) Bottom of cutoff-varies - 1,025.0 (minimum)

(3) Maximum tailwater - unknown

(4) Normal pool - 1,040

(5) Full flood control pool - N/A

(6) Spillway crest - 1,040.0

(7) Design surcharge (Original Design) - 1,043.0± (referred to as maximum high water)

(8) Top of dam - 1,044.75

(9) Test flood surcharge - 1,045.2

d. <u>Reservoir</u> (length in feet)

(1) Normal pool - 3,600

(2) Flood control pool - N/A

(3) Spillway crest pool - 3,600

(4) Top of dam - 4,100

(5) Test flood pool - 4,120

e. <u>Storage</u> (acre-feet)

(1) Normal pool - 259

(2) Flood control pool - N/A

(3) Spillway crest pool - 259

(4) Top of dam - 461

(5) Test flood pool - 483

f. <u>Reservoir Surface</u> (acres)

(1) Normal pool - 37

(2) Flood control pool - N/A

(3) Spillway crest - 37

(4) Test flood pool - 49

(5) Top of dam - 48.5

g. <u>Dam</u>

(1) Type - concrete gravity structure with ogee-shaped overflow section

(2) Length - 35 feet (between abutments)

(3) Height - 15 feet (maximum)

(4) Top Width - varies (4'-6" at training walls and gate house, 3'-0" at overflow section)

(5) Side Slopes - upstream (12V to 1H), downstream (ogee shaped, 1V to 1H)

(6) Zoning - N/A

(7) Impervious core - concrete

(8) Cutoff - concrete curtain, variable width and thickness

(9) Grout curtain - unknown

(10) Other - none

h. Diversion and Regulating Tunnel

Not applicable

i. Spillway

(1) Type - overflow section, ogee-shaped

(2) Length of weir - 26 feet (two 13 feet sections)

(3) Crest elevation - 1,040.0

(4) Gates - N/A

(5) U/S Channel - The banks of Kilburn Pond are tree lined and many bedrock outcroppings are evident. In general, the slopes appear to be stable. The approach channel to the overflow section is unobstructed, except that the sluice gate openings were blocked with sediment. A sample of the debris clogging the sluice gate openings indicated that the material was an unsorted mixture of silt, sand, and gravel.

(6) D/S Channel - The overflow section discharges into a natural stream channel which is approximately 10 feet wide. Below the dam, the channel is rocky and has steeply sloping, tree lined banks until it enters a swampy area approximately 2,300 feet below the dam. The channel becomes wider as it passes through the swampy area, but again narrows as it descends from the swampy area to Route 63.

j. Regulating Outlets

(1) Invert - 6 inch sluice gate - 1,033.5
18 inch sluice gate - 1,031.0

(2) Size - one 6 inch sluice gate and one 18 inch sluice gate

(3) Description - The sluice gates open into a gate chamber that outlets through a 24 inch diameter conduit which discharges at the toe of the dam through a flap gate.

(4) Control Mechanism - Sluice gates are manually operated with hand wheels which are mounted on floor stands that are located in the gate house structure.

SECTION 2
ENGINEERING DATA

2.1 Design

A set of design plans dated 1934 showing plan, elevation and section for construction of the dam are available at the State of New Hampshire Water Resources Board. A set of specifications dated 1934 and a series of material test reports dating between 1934 and 1935 are also on file at the State of New Hampshire Water Resources Board. A set of record plans were obtained from Metcalf and Eddy, Inc., Engineers, Boston, Massachusetts.

2.2 Construction

Construction of the dam was begun in 1934 and completed in 1935 by the O. W. Miller Company, Inc., Springfield, Massachusetts.

2.3 Operation

No engineering operational data were found.

2.4 Evaluation

a. Availability. The Kilburn Pond Dam was designed by Metcalf and Eddy, Inc., Engineers, Boston, Massachusetts and built by O. W. Miller Company, Inc., Springfield, Massachusetts. Other than the design plans, specifications, material test reports and record drawings, no additional engineering data were found.

b. Adequacy. Available engineering data and drawings are considered adequate for a Phase I investigation.

c. Validity. The field investigation indicated that the external features of Kilburn Pond Dam substantially agree with those shown on the record drawings.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. Kilburn Pond Dam impounds a pond of small size (see Photo No. 1). The drainage area above the dam consists of steeply sloped terrain surrounding Kilburn Pond, as well as Baker Pond and a relatively large swampy area which are located upstream from Kilburn Pond. The majority of the basin is heavily wooded and almost completely undeveloped. The immediate downstream channel is undeveloped.

The field inspection of Kilburn Pond Dam was made on May 6, 1980. The inspection team consisted of personnel from S E A Consultants Inc. and Geotechnical Engineers, Inc. Inspection checklists, completed during the visual inspection, are included in Appendix A. At the time of inspection, water was passing approximately 1/4 inch deep over the 26 feet long overflow section. The pool elevation was at approximately 1040.0 feet (NGVD). The upstream face of the dam could only be inspected above this water level.

b. Dam. Kilburn Pond Dam is a concrete gravity structure consisting of an overflow section and gate house structure and is approximately 35 feet long between the ledge abutments (see Plans and Details in Appendix B and Photo No. 2). The dam is approximately 15 feet high from the lowest point of the downstream toe to the top of the overflow section training walls. The overflow section consists of two 13 feet long sections located between 4 feet high concrete training walls. The upstream face of the concrete overflow section is battered at 12 feet vertical to 1 foot horizontal (12V:1H). The downstream face is ogee-shaped and is inclined at 1 foot vertical to 1 foot horizontal (1V:1H) (See Photo No. 7). The overflow section has a maximum height of approximately 11 feet from its crest to the bottom of the channel. The concrete on the downstream face of the overflow section weir exhibited medium scaling (see Photo No. 9). The upstream face of the overflow section was submerged and could not be inspected. The concrete training walls are in good condition except for scaling at the intersection with the overflow section.

The dam appears to be founded on bedrock (see Plans and Details in Appendix B). Both abutments are bedrock (see Photo Nos. 2, 3 and 4). No evidence of leakage through the abutments was observed. Water was flowing over the dam at the time of the inspection, so it was not possible to observe whether any leakage was occurring through the foundation of the dam.

c. Appurtenant Structures. The gate house is located between the left training wall of the overflow section and left abutment and encloses the control mechanisms for a 6 inch and an 18 inch diameter sluice gate (see Photo Nos. 2 and 5). These gates open into a gate chamber that outlets through a 24 inch diameter conduit which discharges at the toe of the dam through a flap gate. At the time of the inspection, the indicator on the floor stand operator for the 6

inch gate showed that the gate was completely open, while the indicator for the 18 inch gate showed that this gate was about half way open. Despite this, there was only a small amount of leakage through the 6 inch gate and no flow at all through the 18 inch gate. Further investigation revealed that there was a mixture of unsorted silt, sand and gravel against the upstream side of the gate structure up to about Elevation 1035.75, completely blocking the entrance to the two gated discharge pipes. The 18 inch gate was operable at the time of inspection, but the 6 inch gate was not. The floor stands were both rusted (see Photo No. 5).

In general, the gate house building was in good condition, although the entrance door had been vandalized and could no longer be lock (see Photo No. 5). The exterior steel face of the door was rusted (see Photo No. 6) and the wooden structure of the door was extensively damaged. There was minor scaling of the concrete on the upstream face of the gate house at the water surface (see Photo No. 6). The interior of the gate house was cluttered with debris apparently left by intruders. The gratings leading to the gate chamber in the lower portion of the gate house structure were extensively rusted, as were the cast in place manhole steps. The flap gate which is located in the downstream face of the gate house structure could not be examined since it was submerged and blocked with debris (see Photo No. 8).

A service bridge extends across the overflow section from the right abutment to the gate house doorway (see Photo Nos. 3 and 4). Each span of the service bridge is constructed of two 7 inch by 2 inch steel channels, covered with a wood deck consisting of 2 inch thick by 6 inch wide by 44 inch long wood planks (see Photo Nos. 4 and 6). Steel pads have been welded to the steel channels and bolted to the overflow section training walls and the center supporting pier. The bolt through one of the eight steel pads is not seated. The head is up approximately 1 inch, but it appears to provide adequate lateral support. There are steel cross braces between the channels under the deck. These braces, as well as the steel channel and pads, are rusted, but it appears that there is no serious structural corrosion (see Photo No. 6). A 2 inch diameter tubular steel railing is attached to the upstream side of the bridge, and is badly rusted (see Photo Nos. 4, 5 and 6). The entire bridge is badly in need of paint (see Photo No. 4).

d. Reservoir Area. The slopes of the reservoir appear to be stable (see Photo No. 1). No evidence of significant sedimentation was observed. The material which blocks the entrance to the gated discharge pipes may be the result of sedimentation, but appears more likely to have been placed there. The approach channel to the dam is otherwise clear and unobstructed (see Photo No. 2).

e. Downstream Channel. The bottom of the channel downstream of the dam consists primarily of bedrock and boulders. Trees overhang both sides of the channel, and some trees are growing in the channel (see Photo No. 10). Cut brush and small logs, which have apparently been carried over the crest of the dam by water discharging from the reservoir, have accumulated in the channel close to the dam (see Photo Nos. 7 and 8).

3.2 Evaluation

On the basis of the results of the visual inspection, Kilburn Pond Dam is considered to be in generally good condition.

Brush and small logs partially block the channel immediately downstream of the dam. This debris also blocks the flap gate which outlets at the downstream face of the gate house structure and will not allow this gate to operate properly. Trees growing on both banks of the downstream channel could block the channel if they blow over or are undermined and fall over into the channel.

The scaling of the concrete on the upstream face of the gate house structure, on the downstream face of the overflow section, and at the intersection of the overflow section and the training walls, although not a major problem at present, could continue and lead to serious deterioration of these structures.

The debris clogging the sluice gates does not allow these gates to be used to discharge water from the pond. Consequently, under present conditions there is no means for low-level withdrawal of water from the pond. The 6-inch gate was in a full open position and was inoperable at the time of inspection. The 18-inch gate was half open and was operable. However, the rusting condition of the gate operators could, if left unattended, also make the 18-inch gate inoperable.

The condition of the gate house doorway does not allow it to be locked and, thereby, keep intruders out of the gate house.

The rusting condition of the steel portions of the service bridge, although not a major problem at present, could lead to serious deterioration of the bridge. The lack of a railing on the downstream side of the service bridge could be a safety hazard.

SECTION 4
OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. Kilburn Pond Dam is used primarily to create Kilburn Pond. There are no written or routine operational procedures.

b. Description of any Warning Systems in Effect. No written warning system exists for the dam.

4.2 Maintenance Procedures

a. General. The owner, the Town of Hinsdale, is responsible for the maintenance of the dam. No formal plan for maintenance exists, and no maintenance appears to have been performed recently.

b. Operating Facilities. No formal plan for maintenance of operating facilities exists.

4.3 Evaluation

The current operation and maintenance procedures for Kilburn Pond Dam are inadequate to ensure that all problems encountered can be remedied within a reasonable period of time. The owners should establish a written operation and maintenance procedure, as well as establish a warning system to follow in event of flood flow conditions or imminent dam failure.

SECTION 5
EVALUATION OF HYDROLOGIC/HYDRAULIC FEATURES

5.1 General. Kilburn Pond Dam is a concrete gravity structure consisting of an overflow section and gate house structure and is approximately 35 feet long between the ledge abutments. The dam is approximately 15 feet high from the lowest point of the downstream toe to the top of the overflow section training walls. The overflow section consists of two 13 feet long sections located between concrete training walls. The entire overflow section consists of an ogee-shaped weir with crest elevation set at 1040.0 feet (NGVD). Located in the gate house structure are two sluice gates. The gates are 6 inches and 18 inches in diameter, with invert elevations of 1033.5 and 1031.0, respectively.

Located upstream from Kilburn Pond are Baker Pond and a relatively large swampy area. Consequently, a large portion of the runoff from the watershed is intercepted by Baker Pond and the swampy area before flowing into Kilburn Pond. The dam is classified as small in size, having a maximum storage of about 461 acre-feet.

5.2 Design Data. Drainage area, pond surface area, and spillway capacity calculations which appear to be design calculations were found attached to a report in the State of New Hampshire Water Resources Board files (see Appendix B).

5.3 Experience Data. No experience data were disclosed. Maximum flood flows or elevations are unknown.

5.4 Test Flood Analysis. Due to the absence of detailed design and operational information, this hydrologic evaluation was performed utilizing data gathered during field inspection, watershed size and an estimated test flood determined from the Corps of Engineers guide curves. For this dam (small size and significant hazard), the test flood ranges from the 100-year flood to one-half the Probable Maximum Flood (1/2 PMF). The 1/2 PMF was selected for this hydrologic analysis. The drainage area consists of steeply sloping terrain. However, the "rolling" curve, from the Corps of Engineers set of guide curves, was used to estimate the maximum probable flood peak flow rate, in order to account for the presence of Baker Pond and the large swampy area which are located upstream from Kilburn Pond.

Based on an estimated maximum probable flood peak flow rate of 2,200 cfs per square mile and a drainage area of 1.65 square miles, the test flood inflow was estimated to be 1,820 cfs. The test flood was routed through the pond in accordance with the Corps of Engineers procedure for Estimating Effect of Surcharge Storage on Maximum Probable Discharge. The reservoir water surface was assumed to be at elevation 1040.0 prior to the flood routing. The routed test flood outflow was estimated to be 1,320 cfs. This analysis indicated that the dam crest would be overtopped by approximately 0.5 feet. The maximum spillway capacity with the water level at the dam crest was estimated to be 1,020 cfs, which is about 77 percent of the routed test flood outflow. The spillway is capable of passing the routed test flood outflow from a 100-year storm event. The test flood inflow for the 100-year storm event was estimated to be 910 cfs, with a routed test flood outflow of 595 cfs.

5.5 Dam Failure Analysis. The impact of dam failure was assessed utilizing the "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs published by the Corps of Engineers. The analysis covered a reach extending approximately 1.8 miles downstream to NH Route 63. The prefailure discharge with the water surface at the dam crest is significant, so prefailure tailwater conditions were included in the calculations and the dam failure analysis was conducted with the water surface at the dam crest. Under these conditions, it was determined that the routed dam failure discharge would significantly increase the hazard over the prefailure discharge tailwater. Based on this analysis, the dam has been classified as a significant hazard structure.

A breach width of 13.2 feet, which is 40 percent of the total length of the dam, and an average failure height of about 14 feet were used to determine the failure discharge. This discharge, combined with flow over the unfailed portion of the spillway, yielded a total failure discharge of 1,940 cfs. Discharge just prior to an assumed breach was estimated to be about 1,020 cfs. The failure discharge would have little impact along the first three stream reaches (first 1.78 miles below the dam) since this portion of the channel is completely undeveloped. The major point of impact of an assumed breach would occur near NH Route 63.

In stream reach 4, the routed failure discharge of 1,720 cfs would result in a stage of about 5.7 feet, which is 2.2 feet more than the stage associated with the prefailure discharge. This increase in stage would cause the dam located approximately 300 feet upstream from New Hampshire Route 63 at an abandoned filtration plant to be overtopped by approximately 1.7 feet. This could compromise the structural integrity of this earthen embankment structure. In stream reach 5, the routed failure discharge of 1,710 cfs would result in a stage of about 11.0 feet, which is 2.6 feet more than the stage associated with the prefailure discharge. The capacity of the culvert beneath NH Route 63 would not be adequate for the failure discharge. Consequently, Route 63 would be overtopped by about 2.5 feet, and the road culvert could be washed out. Water would also rise to nearly 1 foot above the sill level of the house located near the Route 63 road culvert. The potential for loss of less than a few lives would exist, as well as economic loss.

SECTION 6
EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

The visual inspection indicates the following potential structural problems:

(1) The scaling of concrete on the upstream face of the gate house structure, on the downstream face of the overflow section and at the intersection of the overflow section and the training walls, although not a major problem at present, could continue and lead to serious deterioration of these structures

(2) The rusting condition of the steel work associated with the service bridge, if left unattended, could lead to the failure of this structure

Because the pond was filled at the time of inspection, it was not possible to examine the upstream face of the dam or gate house below the surface of the water.

Because water was flowing over the dam and because there was considerable debris at the downstream toe of the dam, it was not possible to examine the downstream face of the dam at close-hand.

Because tailwater was standing at the downstream toe of the dam and because of the debris at the toe of the dam, it was not possible to examine the flap gate at close hand.

6.2 Design and Construction Data

The dam was designed by Metcalf and Eddy, Inc., Engineers, of Boston, Massachusetts in 1934. Construction began late in the same year by the O. W. Miller Company, Inc., of Springfield, Massachusetts, and work was completed in 1935. The design plans indicate the concrete dam is reinforced and built on ledge.

The plans show two features which are important but could not be examined:

(1) Keyways at bottom of dam and gate house structure and at the intersection of ledge abutments with the overflow section and the gate house structure

(2) Conduit extending from gate chamber to the downstream toe of dam

6.3 Post-Construction Changes

There is no record of changes since the construction of the dam.

6.4 Seismic Stability

This dam is located in Seismic Zone 2 and, in accordance with the Phase I guidelines, does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination indicates that Kilburn Pond Dam is in generally good condition. The main concern with respect to the integrity of the dam is:

(1) Lack of a functioning low level regulating outlet that would allow drawdown of the pond in an emergency

Because of this lack of a functioning low-level regulating outlet, the dam has been rated FAIR.

b. Adequacy of Information. Because water was flowing over the concrete section of the dam at the time of the inspection and because of the debris at the downstream toe of the dam, it was not possible to inspect at close hand the downstream face of the dam or the flap gate located on the downstream face of the gate house structure. These features should be inspected at a time when no water is flowing over the dam.

The information available from the visual inspection and hydrologic and hydraulic analyses is adequate to identify the problems listed in 7.2. These problems will require the attention of a qualified registered professional engineer who will have to make additional engineering studies to design or specify remedial measures. No additional information is needed for the purpose of this Phase I inspection.

c. Urgency. The owner should implement the recommendations in 7.2 and 7.3 within one year after receipt of this Phase I report.

7.2 Recommendations

The owner should retain a registered professional engineer qualified in the design and construction of dams to:

(1) Investigate the source of the debris blocking the low level outlets and the inoperability of the gate lifting mechanism and design remedial measures to keep these outlets operable.

(2) Inspect the downstream face of the dam and the flap gate once the debris has been removed from the discharge channel.

The owner should carry out the recommendations made by the engineer.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. The owner should:

(1) Repair all scaled concrete on the upstream face of the gate house structure, the downstream face of the overflow section and the training walls

(2) Repair or replace the gate house door in order to keep intruders out

(3) Remove loose rust and repaint the service bridge and other rusted equipment

(4) Remove brush and debris from the discharge channel

(5) Establish a regular operation and maintenance program

(6) Visually inspect the dam and appurtenant structures once a month

(7) Engage a registered professional engineer qualified in the design and construction of dams to make a comprehensive technical inspection of the dam once every one year.

(8) Establish a surveillance program for use during and immediately after periods of heavy rainfall, establish written procedures to be followed during flooding periods, and also establish a formal downstream warning program to follow in case of emergency.

7.4 Alternatives

There are no practical alternatives to the recommendations of Section 7.2 and 7.3.

APPENDIX A
INSPECTION CHECKLIST

INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT: Kilburn Pond Dam

DATE: May 6, 1980

TIME: 12:10 p.m.

WEATHER: Clear, warm

W.S. ELEV. 1040.0 U.S. 1032.5 DN.S.
(NGVD)

PARTY:

1. Kenneth Stewart, S E A
2. Bruce Pierstorff, S E A
3. Ronald Hirschfeld, GEI
4.
5.
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Structural Stability	Kenneth Stewart	
2.	Hydrology/Hydraulics	Bruce Pierstorff	
3.	Soils and Geology	Ronald Hirschfeld	
4.			
5.			
6.			
7.			
8.			
9.			
10.			

INSPECTION CHECK LIST

PROJECT: Kilburn Pond Dam DATE: May 6, 1980

PROJECT FEATURE: Dam Embankment NAME:

DISCIPLINE: NAME:

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	1040.0
Current Pool Elevation	1040.0
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	Not paved
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good - Concrete structure keyed to ledge
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	N/A
Vegetation on Slopes	N/A
Sloughing or Erosion of Slopes or Abutments	N/A
Rock Slope Protection - Riprap Failures	N/A
Unusual Movement or Cracking at or near Toe	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	N/A
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	None

INSPECTION CHECK LIST

PROJECT: Kilburn Pond Dam DATE: May 6, 1980

PROJECT FEATURE: Dike Embankment NAME:

DISCIPLINE: NAME:

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	No dike
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	
Pavement Condition	
Movement or Settlement of Crest	
Lateral Movement	
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	
Trespassing on Slopes	
Vegetation on Slopes	
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	
Unusual Embankment or Downstream Seepage	
Piping or Boils	
Foundation Drainage Features	
Toe Drains	
Instrumentation System	

INSPECTION CHECK LIST

PROJECT: Kilburn Pond Dam DATE: May 6, 1980

PROJECT FEATURE: Intake Channel NAME:

DISCIPLINE: NAME:

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Good - ledge
Bottom Conditions	Sedimentation to Elev. 1035.75 - both gates blocked
Rock Slides or Falls	None
Log Boom	None
Debris	None
Condition of Concrete Lining	Not applicable
Drains or Weep Holes	None
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	None

INSPECTION CHECK LIST

PROJECT: Kilburn Pond Dam | DATE: May 6, 1980

PROJECT FEATURE: Control Tower | NAME: ____

DISCIPLINE: ____ | NAME: ____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	Minor scaling at upstream water surface
Visible Reinforcing	None
Rusting or Staining of Concrete	Minor
Any Seepage or Efflorescence	None visible
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None
Cracks	None
Rusting or Corrosion of Steel	Gratings to well rusted
b. Mechanical and Electrical	
Air Vents	None
Float Wells	None
Crane Hoist	None
Elevator	None
Hydraulic System	None
Service Gates, Emergency Gates	6" dia gate open full, 18" dia gate opened half -both gates blocked by sedimentation -minor flow through 6" dia gate - gate control mechanism extensively corroded; 18" dia gate operable, 6" dia gate inoperable
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System	None

INSPECTION CHECK LIST

PROJECT: Kilburn Pond Dam

DATE: May 6, 1980

PROJECT FEATURE: Transition and Conduit

NAME:

DISCIPLINE:

NAME:

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	24-inch diameter conduit submerged; could not inspect
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

INSPECTION CHECK LIST

PROJECT: Kilburn Pond Dam DATE: May 6, 1980

PROJECT FEATURE: Outlet Structure NAME:

DISCIPLINE: NAME:

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	24-inch flap gate submerged; could not inspect
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	None
Channel	
Loose Rock or Trees Overhanging Channel	Many trees overhanging channel
Condition of Discharge Channel	Brush and logs in channel

INSPECTION CHECK LIST

PROJECT: Kilburn Pond Dam DATE: May 6, 1980

PROJECT FEATURE: Spillway Weir NAME: ______

DISCIPLINE: ______ NAME: ______

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Conditions	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Good; appears to be bedrock
b. Weir and Training Walls	
General Condition of Concrete	Fair to good
Rust or Staining	Not Visible
Spalling	Medium scaling on spillway weir and at intersection of training walls
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None visible
Drain Holes	None
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	Some
Trees Overhanging Channel	Many
Floor of Channel	Bedrock and boulders
Other Obstructions	Collected brush at foot of spillway

INSPECTION CHECK LIST

PROJECT: Kilburn Pond Dam DATE: May 6, 1980

PROJECT FEATURE: Service Bridge NAME: ____________

DISCIPLINE: ____________ NAME: ____________

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	
Bearings	Steel pads welded to channels and bolted to concrete; pads are rusted
Anchor Bolts	1 bolt of 8 not seated; head up approximately 1 inch but appears to provide lateral support
Bridge Seat	Concrete - good condition
Longitudinal Members	7" x 2" steel channels, 2 each span; rusted but no serious corrosion
Under Side of Deck	See secondary bracing
Secondary Bracing	Steel cross braces between channels under deck
Deck	2" x 6" wood plank
Drainage System	None
Railings	2" diameter tubular steel railing, upstream side only, badly rusted
Expansion Joints	No expansion joints
Paint	Entire service bridge badly in need of paint
b. Abutment & Piers	
General Condition of Concrete	Good
Alignment of Abutment	Good
Approach to Bridge	Ledge
Condition of Seat & Backwall	Good

APPENDIX B

ENGINEERING DATA

AVAILABLE ENGINEERING DATA

A set of design plans dated 1934 showing plan, elevation and section for construction of Kilburn Pond Dam, with a set of specifications dated 1934 and a series of material test reports dating between 1934 and 1935 are available at the State of New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301. A set of record plans were obtained from Metcalf and Eddy, Inc., Engineers, 50 Staniford Street, Boston, Massachusetts 02114.

PAST INSPECTION REPORTS

State of New Hampshire
WATER RESOURCES BOARD
37 Pleasant Street
Concord, N.H. 03301
TELEPHONE 271-3406

November 13, 1979

Commissioner George T. Gilman
Dept. of Resources & Economic Development
Parks Division
Loudon Road
Concord, New Hampshire 03301

Dear Commissioner Gilman:

Under the provisions of RSA Chapter 482, Sections 8 through 15, the New Hampshire Water Resources Board is authorized to inspect all dams in the State which by reason of their physical condition, height, and location may be a menace to public safety.

The dam structure (No. 255.09) located on your property in Kilburn Pond in Pisgah S. P., New Hampshire was inspected on November 8, 1979 and as a result of this inspection no visual discrepancies were found at the time of the inspection which would require any corrective measures.

This letter is provided for your information only. If you have any questions, please feel free to call or write.

Sincerely,

George M. McGee Sr.

George M. McGee, Sr.,
Chairman

GMM:paf

cc: Board of Selectmen,

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: WINCHESTER Dam Number: 255.09

Name of Dam, Stream and/or Water Body: KILBURN POND

Owner: DRED PARKS DEPT Telephone Number:

Mailing Address:

Max. Height of Dam: 6'± TO CREST Pond Area: SEE USGS Length of Dam: 35'

FOUNDATION: LEDGE GOOD CONDITION

OUTLET WORKS:

OGEE SPILLWAY 26' LONG

2 GATE STEMS AND CRANKS 1-6" AND 1-18" CONDUIT

GATE SLOT U/S OF 2 STEMS

ABUTMENTS: LEDGE

EMBANKMENT: LEDGE

Note: Give Sizing, Condition and detailed description for each item, if applicable.

Dam No. 255.09

SPILLWAY: Length: 26' Freeboard: 4.75' TO TOP OF CATWALK

DAM IS CONC GRAVITY ON LEDGE SO FREEBOARD IS ACTUALLY INFINATE

SEEPAGE: Location, estimated quantity, etc.

NONE OBSERVED

Changes Since Construction or Last Inspection:

Tail Water Conditions:

MOUNTAIN BROOK

Overall Condition of Dam: GOOD

Contact With Owner: NO

Date of Inspection: 11/7/79 Suggested Reinspection Date

Class of Dam: NON-MENACE

SMALL DAM, VERY REMOTE

Signature Kenneth Stern

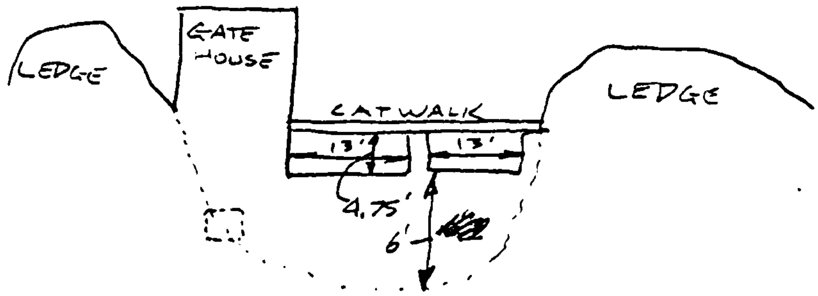
Date

Note: Give Sizing, Condition and detailed description for each item, if applicable.

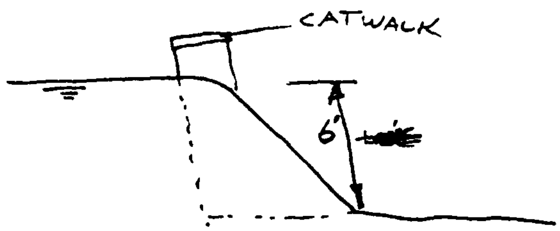
Dam No. 255.09

COMMENTS: NO VISUAL DISCREPANCIES

SKETCH OF DAM (Show Plan, Elevation & Cross Sections)



ELEVATION



SECTION

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 255.09

Town Winchester : County Cheshire

Stream Kilburn Pond

Basin-Primary Conn. R. : Secondary Kilburn Bk. Ashuelot R.

Local Name

Coordinates—Lat. : Long.

GENERAL DATA

Drainage area: Controlled Sq. Mi.: Uncontrolled Sq. Mi.: Total 1.63 Sq. Mi.

Overall length of dam 35 ft.: Date of Construction 1935

Height: Stream bed to highest elev. 15 ft.: Max. Structure 10.25 ft.

Cost—Dam : Reservoir

DESCRIPTION Concrete .Ogee face

Waste Gates

Type

Number : Size ft. high x ft. wide

Elevation Invert : Total Area sq. ft.

Hoist

Waste Gates Conduit

Number 2 : Materials

Size 6", 18" ft.: Length ft.: Area sq. ft.

Embankment

Type

Height—Max. ft.: Min. ft.

Top—Width : Elev. ft.

Slopes—Upstream on : Downstream on

Length—Right of Spillway : Left of Spillway

Spillway

Materials of Construction concrete

Length—Total 2bays@13' = 26' ft.: Net ft.

Height of permanent section—Max. 10.25 ft.: Min. ft.

Flashboards—Type : Height ft.

Elevation—Permanent Crest 1040 : Top of Flashboard

Flood Capacity cfs.: cfs/sq. mi.

Abutments

Materials:

Freeboard: Max. 4.75 ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Hinsdale Water Works

REMARKS (To be inspected)

Tabulation By RLT Date 9/27/39

R&D21234

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN [illegible] NO. [illegible] 255.09
RIVER [illegible] MILES FROM MOUTH ____ D.A.SQ.MI 1.65
TOWN [illegible] OWNER [illegible] Water Works
LOCAL NAME OF DAM
BUILT [illegible] DESCRIPTION [illegible]

(2) before raising dam
POND AREA-ACRES 35 DRAWDOWN FT. 7.5 POND CAPACITY-ACRE FT. [illegible]
HEIGHT-TOP TO BED OF STREAM-FT. 15 MAX. MIN.
OVERALL LENGTH OF DAM-FT. 35 MAX.FLOOD HEIGHT ABOVE CREST-FT.
PERMANENT CREST ELEV.U.S.G.S. 1242 LOCAL GAGE
TAILWATER ELEV.U.S.G.S. LOCAL GAGE
SPILLWAY LENGTHS-FT. 2 @ 13' = 26' FREEBOARD-FT. 2.75
FLASHBOARDS-TYPE,HEIGHT ABOVE CREST
WASTE GATES-NO. WIDTH MAX. OPENING DEPTH SILL BELOW CREST

NO.	WIDTH MAX. OPENING	DEPTH SILL BELOW CREST
1	[illegible]	
1	[illegible]	

REMARKS [illegible]
[illegible] Ashuelot [illegible]

POWER DEVELOPMENT

UNITS NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE Water Supply for Town of Hinsdale.

REMARKS Information from Howard T. Streeter, Water Commissioner
Designed [illegible] Metcalf & Eddy of Boston. Capacity [illegible] Runoff
[illegible] 800 C.F.S. / [illegible] 3' over spillway
Built [illegible] Williams Co. Inc. Springfield Mass. Contractors
Site of dam owned by Ansel Dickinson Sons

DATE [illegible]

To be [illegible]

CALCULATION SHEET

Co. No.
Date
Refers to 1-27
Made By

U.S.G.S. Topo Map ... 1925.

Pelham Pond Dr. — Pelham Pond's WS

4473 — 4022
4406 .67 sq mi — 4020 .02 sq mi = 12.5 acres

Kilburn Pond Dr. (includes Pelham Pond Dr.) — Kilburn Pond WS

2279 — 4563
2114 $\boxed{1.65 \text{ sq mi}}$ — 4559 .04 sq mi = 25.6 acres.

ADDITIONAL DA

DOWN TO 800 CONTOUR 800 − 250 = 550 x .43 = 236.5# per "
5922
5738 .84 sq mi

DOWN TO 700 CONTOUR 700 − 250 = 450 x .43 193.5# "
5719
5822 .97 sq mi

DOWN TO 600 CONTOUR 600 − 250 = 350 x .43 150.5# "
6023
5912 1.04 sq mi

DOWN TO 500 CONTOUR 500 − 250 = 250 x .43 107.5# "
6277
5951 3.26 sq mi

METCALF + EDDY MAP

SURFACE AREA AT ELE 1040 ELE 1040 40.37
2595 " 1035 27.74 ... Av = 34.10
0835 17.60 app. 34.1 x 40000 = 1364000 cu' in 1' depth, 5' ...
1447 = 6820000 cu', = 51,150000 gals
9272 16.21
3405
2749 6.56 40.37$^{\square''}$ = 1614800$^{\square'}$ = $\boxed{37.06 \text{ acres}}$ = .0579$^{\square}$ mi

AT ELE 1035 ELE 1035 27.74
9909 " 1032.5 22.28 ... Av 25.01
8788 11.21 app 25.01 x 40000 = 1002400 cu' in 1' depth, 2½' depth
4369 = 2506000 cu' = 18795000 gals
2860 15.09 6420000 " = 51150000 "
3557 TOTAL 8926000 " = 69945000 "
3405 1.54 27.84$^{\square''}$ = 1113600$^{\square'}$ = $\boxed{25.57 \text{ acres}}$ = .0399 $^{\square}$ mi

AT ELE 1032.5

LAKE SURFACE ... 1234

0835
9909 .926
2751
1447 13.0 ... 22.28$^{\square''}$ = 891200$^{\square'}$ = $\boxed{20.46 \text{ acres}}$ = .0319 $^{\square}$ mi

Co. ....

No. ....

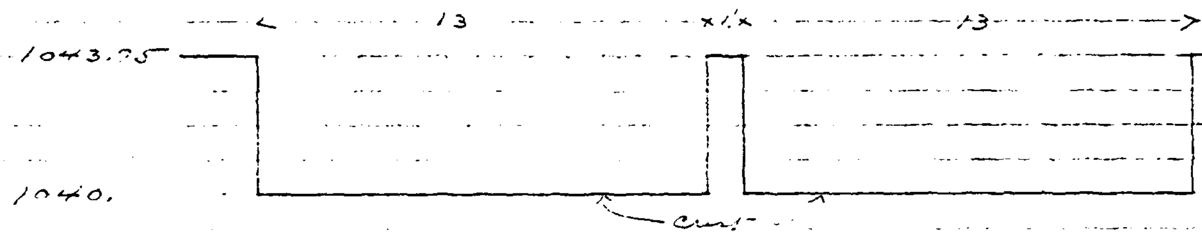
CALCULATION SHEET

Date 11-7-3[illegible]

Refers to 1-3[illegible]

Made By [illegible]

2279
2114   1.65 × 242 = 399.3 sec'

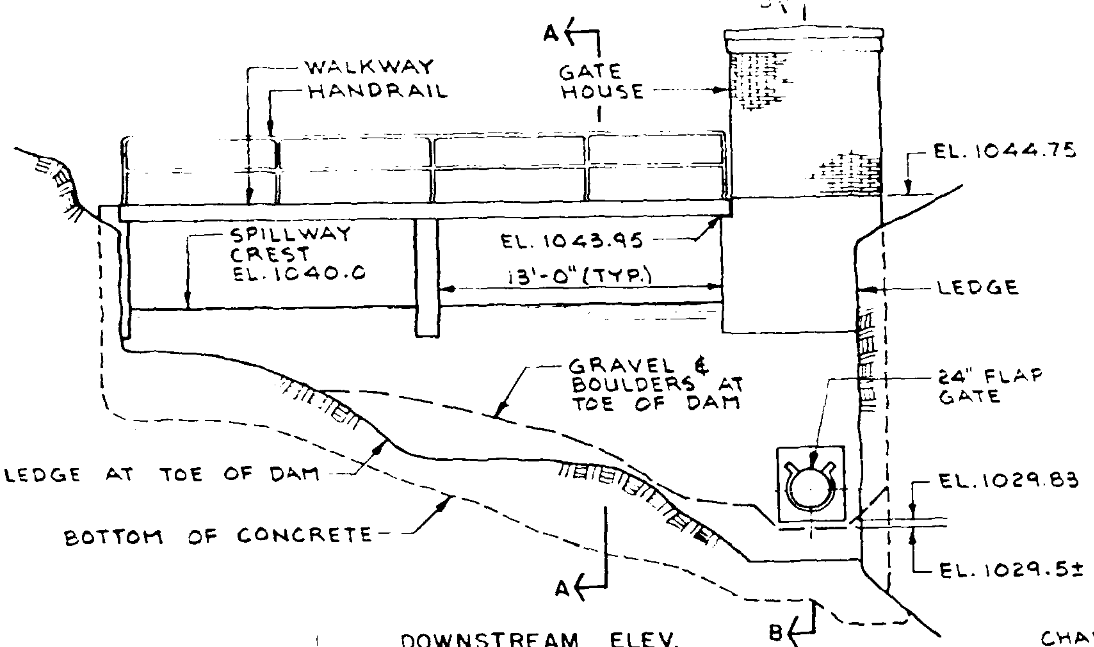


H	Disp. ft	.4×H	L-(.4×H)	Dis. sec'
1	3.32	.4	25.6	85.24
1.5	6.11	.6	25.4	155.19
2.	9.41	.8	25.2	237.12
2.5	13.16	1.	25.	329.00
2.7	14.77	1.08	24.92	368.06
2.8	15.60	1.12	24.88	388.12
2.85	16.02	1.14	24.86	398.25
2.86	16.10	1.144	24.856	400.18
2.87	16.19	1.148	24.852	402.35
2.88	16.27	1.152	24.848	404.27
2.89	16.36	1.156	24.844	406.44
2.90	16.44	1.16	24.84	408.36
3	17.30	1.2	24.8	429.04
3.5	21.80	1.4	24.6	536.28
3.95	26.14	1.58	24.42	638.33

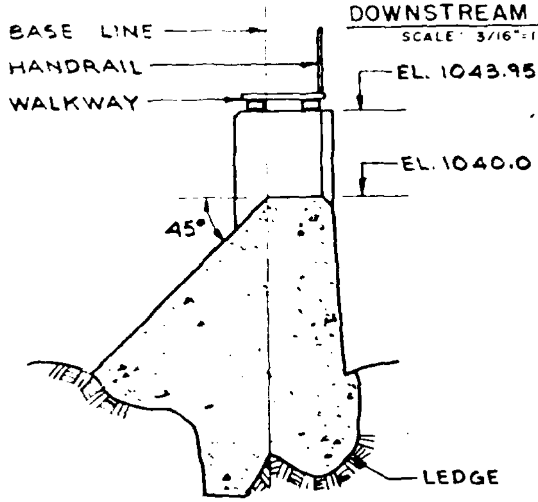
Max expected flood 1.09' below Top. (beside row 2.86)

[illegible] (beside row 3.95)

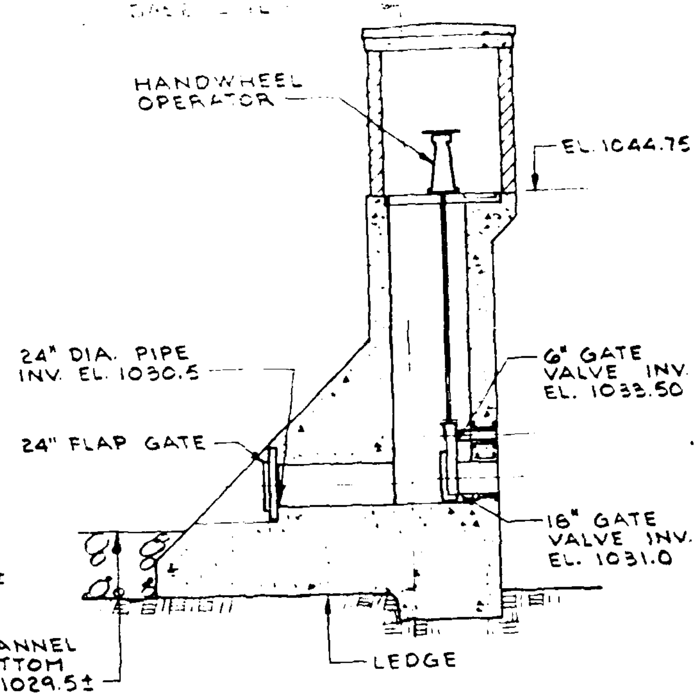
PLANS AND DETAILS



DOWNSTREAM ELEV.
SCALE: 3/16"=1'-0"



SECTION A-A
SCALE: 3/16"=1'-0"



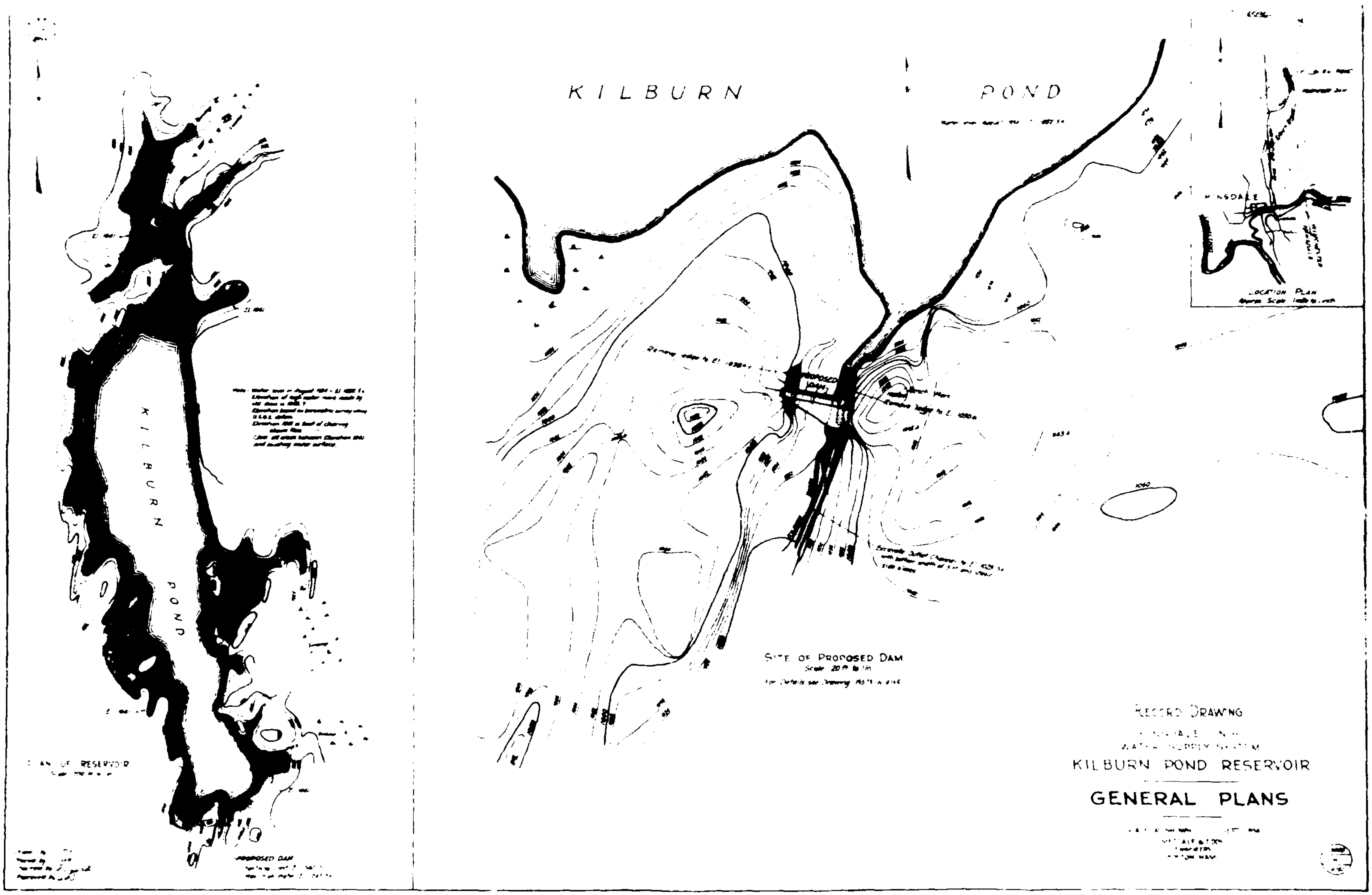
SECTION B-B
SCALE 3/16"=1'-0"

NOTES:
1.) THE ELEVATIONS SHOWN ARE BASED ON U.S.G.S. DATUM FROM INFORMATION OBTAINED FROM THE 1934 DAM CONSTRUCTION PLANS, BY METCALF & EDDY ENGINEERS.
2.) THE INFORMATION SHOWN ON THIS DRAWING IS BASED ON THE EXISTING CONSTRUCTION PLANS AND VISUAL OBSERVATIONS MADE DURING THE FIELD INSPECTION. DIMENSIONS OF MATERIALS INDICATED ON THIS DRAWING WHICH WERE BELOW GRADE OR WATER DURING THE TIME OF INSPECTION WERE NOT VERIFIED.

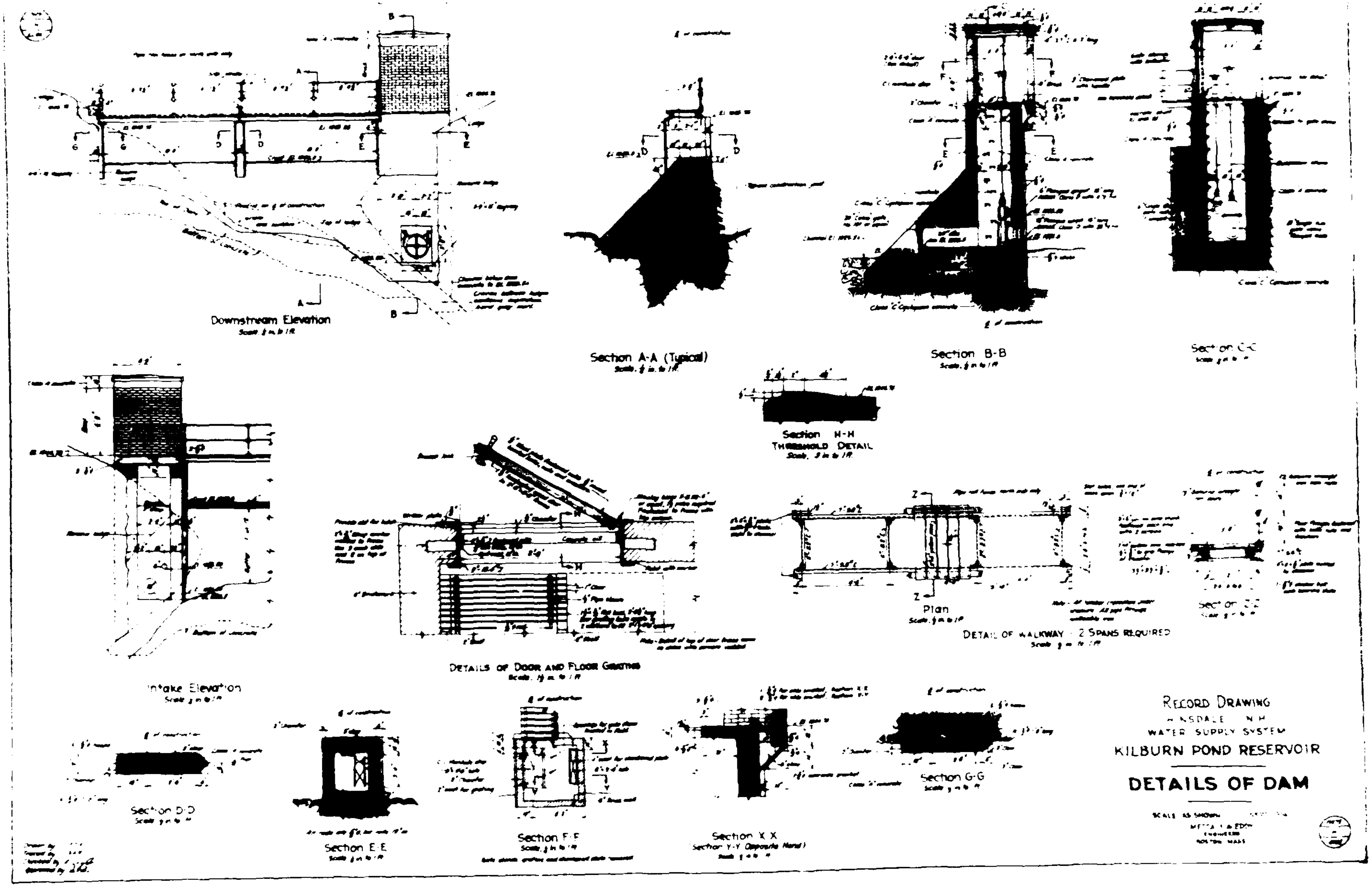
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

KILBURN POND DAM

HINSDALE, NEW HAMPSHIRE



KILBURN POND
KILBURN POND
PLAN OF RESERVOIR
PROPOSED DAM
HINSDALE
LOCATION PLAN
SITE OF PROPOSED DAM
Scale 20 ft to 1 in
RECORD DRAWING
KILBURN POND RESERVOIR
GENERAL PLANS


Downstream Elevation
Section A-A (Typical)
Section B-B
Section C-C
Section H-H
Threshold Detail
Intake Elevation
Details of Door and Floor Gratings
Plan
Section Z-Z
Detail of Walkway - 2 Spans Required
Section D-D
Section E-E
Section F-F
Section X-X
Section Y-Y (Opposite Hand)
Section G-G
Record Drawing
Hinsdale N.H.
Water Supply System
Kilburn Pond Reservoir
Details of Dam
Scale as shown
Metcalf & Eddy
Engineers
Boston, Mass.

APPENDIX C

SELECTED PHOTOGRAPHS

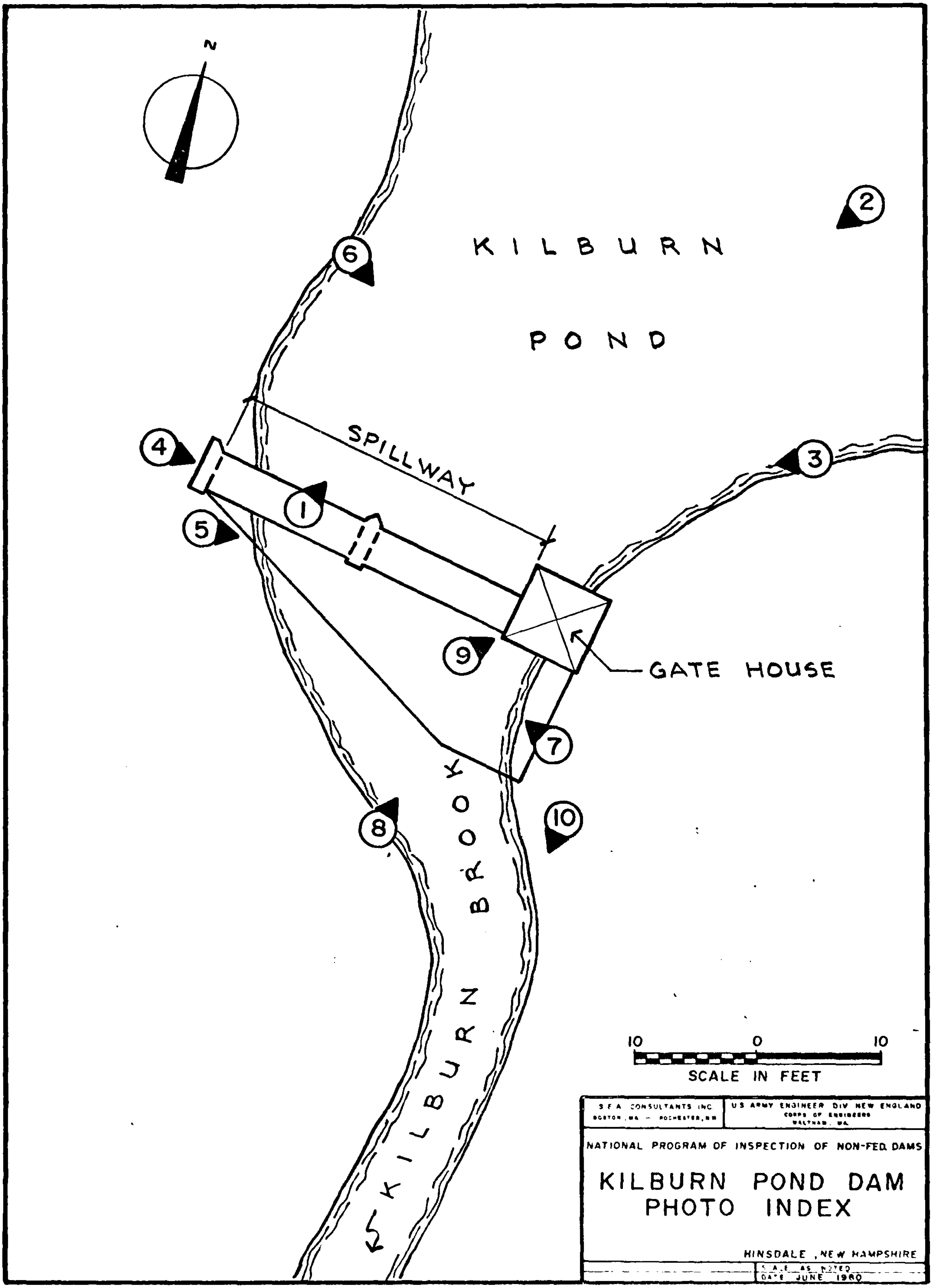

N
KILBURN
POND
SPILLWAY
GATE HOUSE
KILBURN BROOK
1
2
3
4
5
6
7
8
9
10
10 0 10
SCALE IN FEET
S E A CONSULTANTS INC.
BOSTON, MA — ROCHESTER, NH
US ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MA
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
KILBURN POND DAM
PHOTO INDEX
HINSDALE, NEW HAMPSHIRE
SCALE AS NOTED
DATE JUNE 1980

Photo No. 1 - General view of lake from dam.

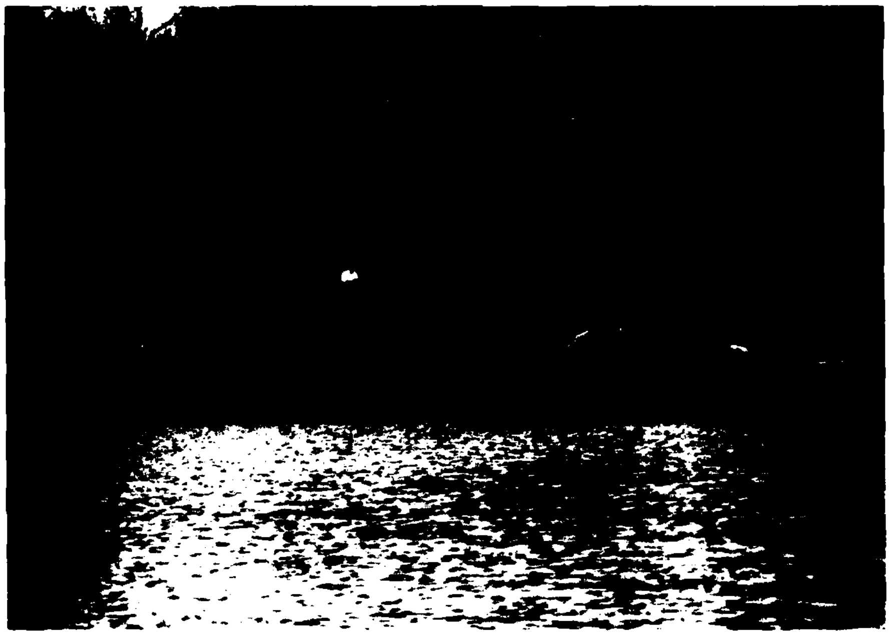


Photo No. 2 - General view of dam from lake.

Photo No. 5 - Close-up of gate house.

Photo No. 6 - Close-up view of upstream face of gate house.

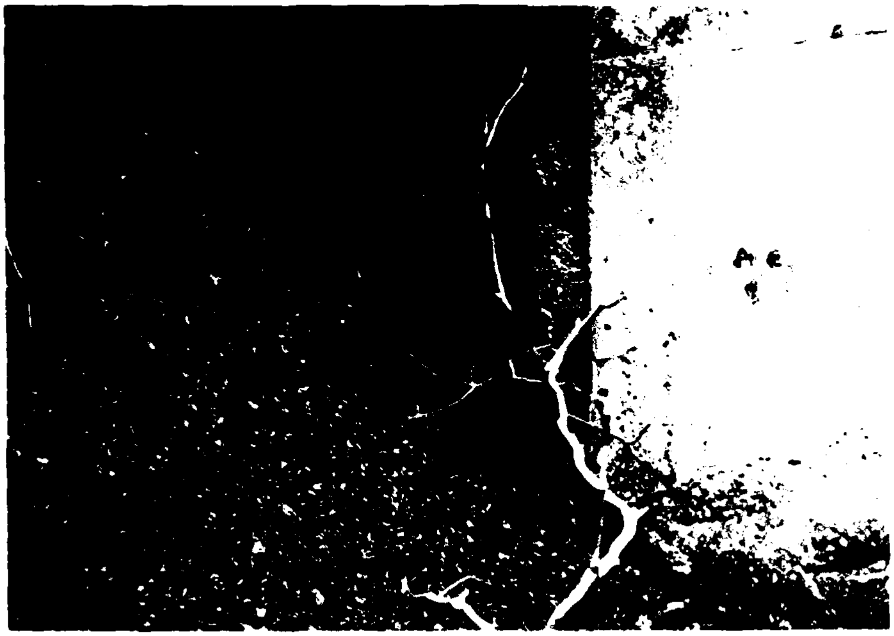


Photo No. 9 - Close-up of scaling at intersection of downstream face of spillway and training wall.

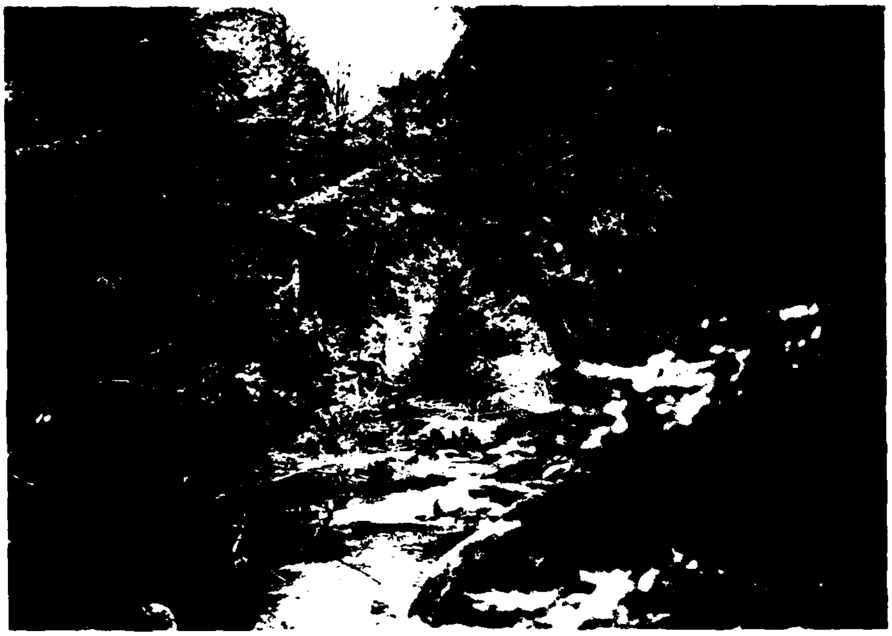
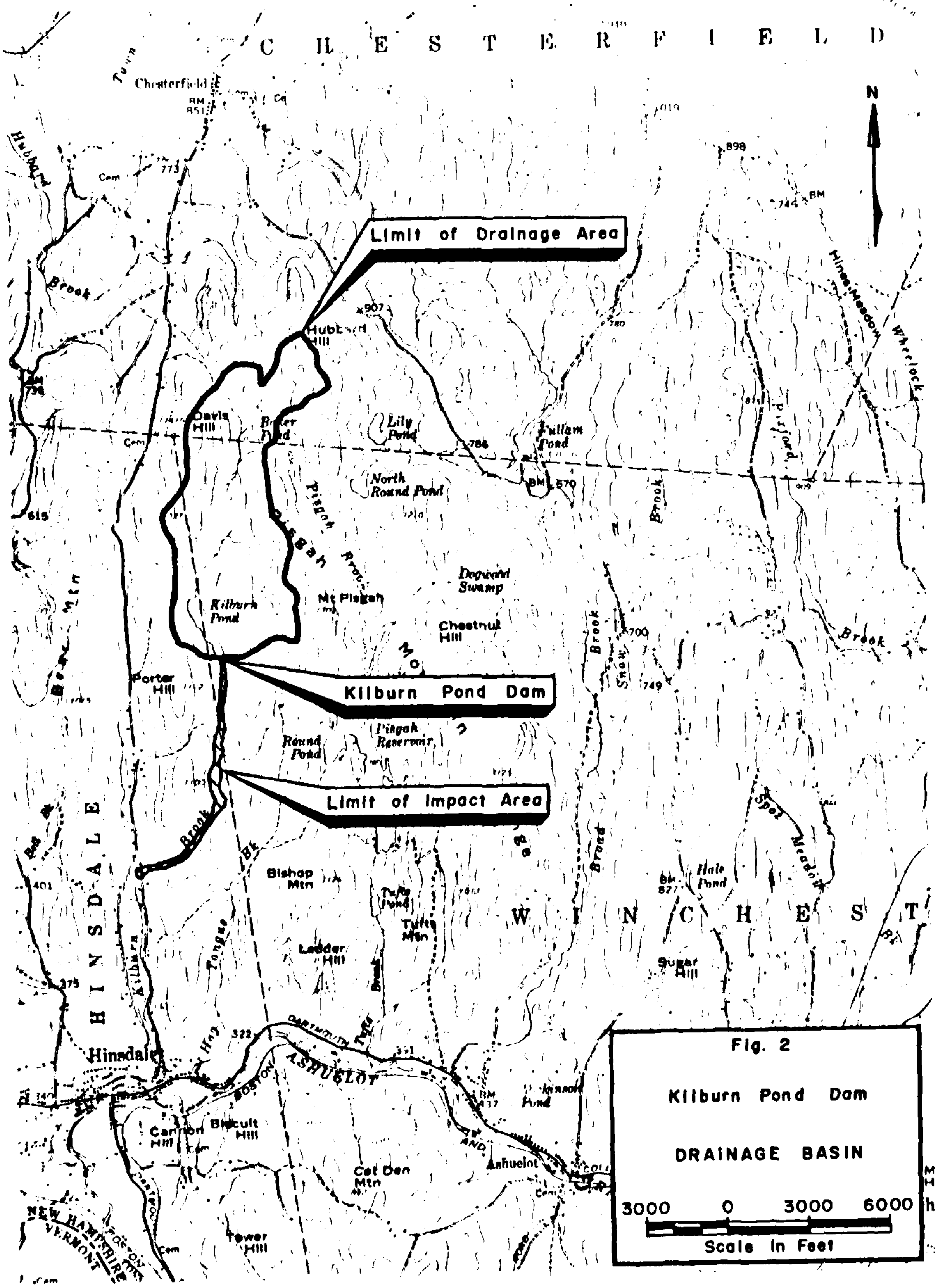


Photo No. 10 - Downstream channel from toe of dam.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS


C H E S T E R F I E L D
N
Limit of Drainage Area
Hubbard Hill
Davis Hill
Lily Pond
Fullam Pond
North Round Pond
Pisgah Brook
Dogwood Swamp
Kilburn Pond
Mt Pisgah
Chestnut Hill
Kilburn Pond Dam
Porter Hill
Pisgah Reservoir
Round Pond
Limit of Impact Area
Bishop Mtn
Hale Pond
W I N C H E S T
H I N S D A L E
Ladder Hill
Sugar Hill
Tufts Mtn
Hinsdale
ASHUELOT
Carmon Hill
Biscuit Hill
Cat Den Mtn
Ashuelot
Tower Hill
NEW HAMPSHIRE
VERMONT
Fig. 2
Kilburn Pond Dam
DRAINAGE BASIN
3000 0 3000 6000
Scale in Feet

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CLIENT Army Corps of Engineers JOB NO. 274-7901 PAGE 1 OF 25
PROJECT Kilfian Pond Dam COMPTD. BY KMS DATE [illegible]
DETAIL Hydrologic Calcs CK'D. BY BWP DATE 5 5 80

I. BASIC DATA

A. DRAINAGE AREA

1. 1.65 SQ. MILES – FROM CALCS DATED 2/5/80; CHECKED BY PLANIMETERING ON U.S.G.S. SHEET

2. DRAINAGE AREA WOULD BE CLASSIFIED AS MOUNTAINOUS, BUT USE ROLLING CURVE FOR ESTIMATING MPF TO ACCOUNT FOR BAKER POND AND SIGNIFICANT SWAMPY AREAS IN DRAINAGE BASIN.

B. DAM AND STORAGE INFORMATION

1. SIZE CLASSIFICATION: SMALL BASED ON STORAGE (≥ 50 AND $< 1,000$ ACRE-FEET)

AS INDICATED BELOW, STORAGE AT CREST OF DAM ESTIMATED TO BE 461 ACRE-FEET

2. HAZARD POTENTIAL: SIGNIFICANT

MAY IMPACT ONE HOUSE AND STATE ROUTE 9E AT FIRST ROADWAY CROSSING APPROX. .3 MILES BELOW DAM

3. STORAGE INFORMATION

DESCRIPTIVE INFORMATION	ELEVATION, FEET (NGVD)	SURFACE AREA (ACRES)	STORAGE ACRE-FEET)
1050 CONTOUR	1050.0	60.0	744
1045 CONTOUR	1045.0	48.5	475
CREST OF DAM	1044.75	47.9	461
SPILLWAY CREST	1040.0	37.07 *	259
1035 CONTOUR	1035.0	25.56 *	—
WATER SURFACE (AUG. 1984)	1032.5	20.46 *	—
APPROX. POND BOTTOM @ DAM	1030.0	15.4	0
TEST FLOOD	1045.2	[illegible]	483

NOTES (1) SURFACE AREAS INDICATED BY (*) ARE FROM CALCS DATED 12/5/34

(2) SURFACE AREA @ 1045 CONTOUR DETERMINED BY PLANIMETERING METCALF & EDDY PLAN DATED SEPT. 1934; OTHER SURFACE AREAS BY INTERPOLATION & PROJECTION

C. SPILLWAY INFORMATION

1. PERMANENT SPILLWAY CONSISTS OF A 26.0 FEET LONG OGEE-CRESTED WEIR; SPILLWAY CREST ELEV. = 1040.0

2. DISCHARGE OVER SPILLWAY GIVEN BY BROAD-CRESTED WEIR EQUATION

$$Q = CLH^{3/2}$$ (STANDARD HANDBOOK FOR CE'S, MERRITT)

WHERE: Q = DISCHARGE, cfs
L = WEIR LENGTH, feet
H = HEAD ABOVE CREST, feet
C = DISCHARGE COEFF. — NUMERICALLY DEFINED BY FIG. 21-67 IN MERRITT'S TEXT

II. ESTIMATE EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGE

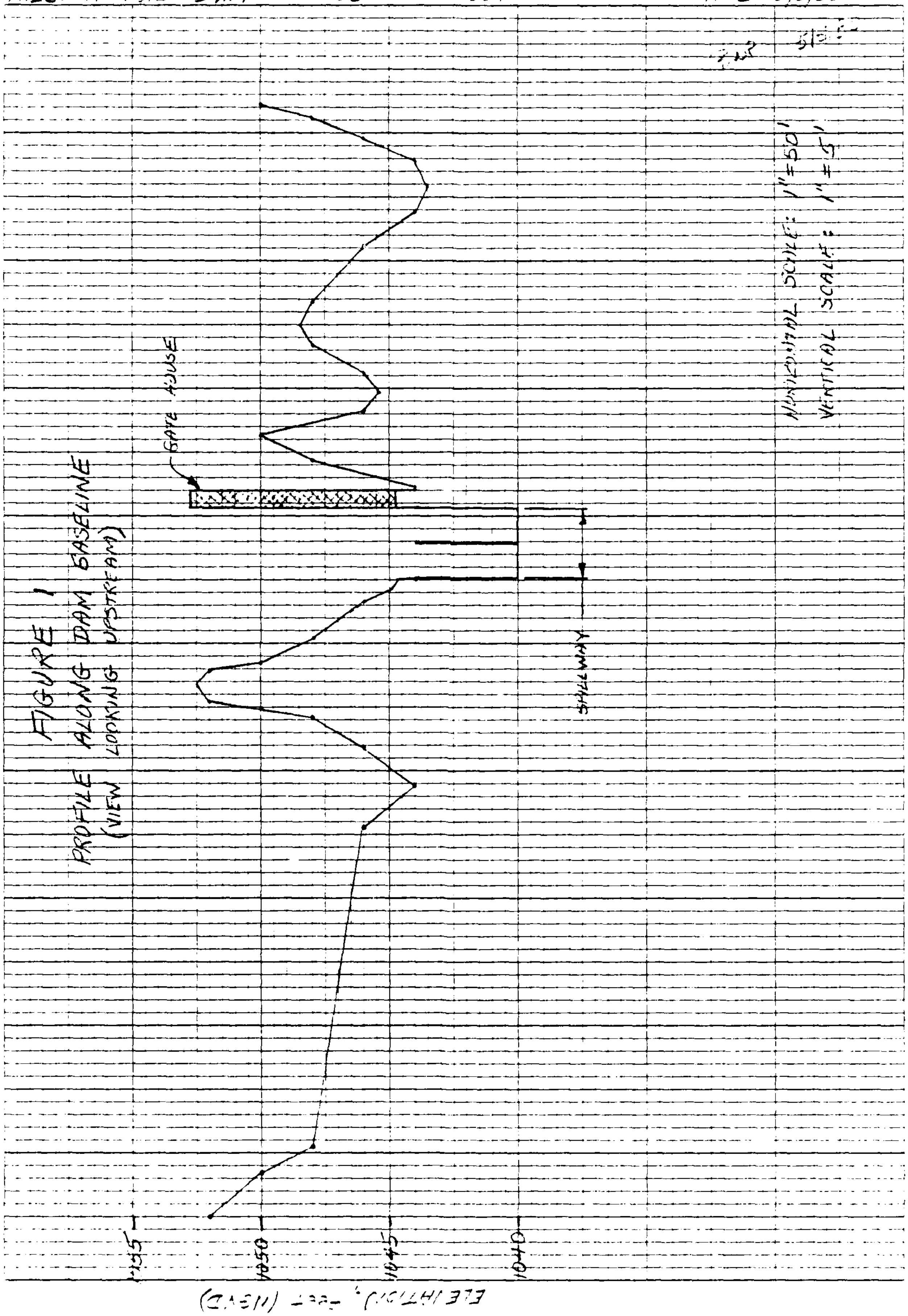
A. DEVELOP STAGE-DISCHARGE CURVE FOR OUTFLOW FROM DAM

1. DEFINE SOURCES OF OUTFLOW

a. DISCHARGE OVER SPILLWAY — ABOVE ELEV. 1040.0 — AS DEFINED ABOVE

b. DISCHARGE OVER ABUTMENTS AND OTHER LOW AREAS ALONG DAM BASELINE (SEE FIGURE 1) ABOVE ELEV. 1043.5 — USE BROAD-CRESTED WEIR EQUATION WITH $C = 2.6$

KILESKI POND DAM JOB # 274-7301 RMS 5/2/80



2. DISCHARGE OVER SPILLWAY

ELEVATION, feet (NGVD)	C	L (feet±)	H (feet)	Q (cfs)
1040.0	—	—	0	0
1041.0	3.4	26	1	88
1042.0	3.6	↓	2	265
1043.0	3.65		3	493
1044.0	3.75		4	780
1045.0	3.85		5	1120
1046.0	3.9		6	1490
1047.0	3.95		7	1900
1048.0	3.95		8	2320
1049.0	3.95		9	2770
1050.0	3.95	↓	10	3250

3. DISCHARGE AT LEFT ABUTMENT (ABOVE ELEV. 1044.0)

ELEVATION, feet (NGVD)	C	L (feet)	avg H (feet)	Q (cfs)
1044.0	—	—	0	0
1045.0	2.6	3	0.5	3
1046.0	↓	6	1	16
1047.0		9	1.5	43
1048.0		12	2	88
1049.0		17	2.5	175
1050.0	↓	22	3	297

4. DISCHARGE AT LOW POINT 33 FEET EAST OF LEFT ABUTMENT

ELEVATION, feet (NGVD)	C	L (feet)	avg H (feet)	Q (cfs)
1046.0	2.6	15	0.25	5
1047.0		23	0.75	39
1048.0		30	1.25	88
1049.0		41	1.75	247
1050.0	↓	44	2.25	386

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PROJECT [illegible] Dam COMPTD. BY VMS DATE 5-2-80
DETAIL Hydrologic Calcs CK'D. BY BWP DATE 5/5/80

5. DISCHARGE AT LOW POINT 110 FEET EAST OF LEFT ABUTMENT

ELEVATION, feet (NGVD)	C	L (feet)	avg H (feet)	Q (cfs)
1044.0	2.6	20	0.25	7
1045.0	↓	31	0.75	52
1046.0		42	1.25	153
1047.0		57	1.75	343
1048.0		72	2.25	632
1049.0		84	2.75	996
1050.0	↓	96	3.25	1510

6. DISCHARGE AT RIGHT ABUTMENT (ABOVE ELEV. 1044.75)

ELEVATION, feet (NGVD)	C	L (feet)	avg H (feet)	Q (cfs)
1045.0	2.6	4	0.12	<1
1046.0	↓	8	0.62	10
1047.0		15	1.12	46
1048.0		23	1.62	123
1049.0		28	2.12	225
1050.0	↓	33	2.62	364

7. DISCHARGE AT LOW POINT 32 FEET WEST OF RIGHT ABUTMENT

ELEVATION, feet (NGVD)	C	L (feet)	avg H (feet)	Q (cfs)
1044.0	—	—	0	0
1045.0	2.6	15	0.5	14
1046.0	↓	31	1.0	8[illegible]
1047.0		95	1.0	247
1048.0		163	1.4	724
1049.0		175	2.3	1597
1050.0	↓	182	3.2	2709

CLIENT [illegible]　　JOB NO. ____

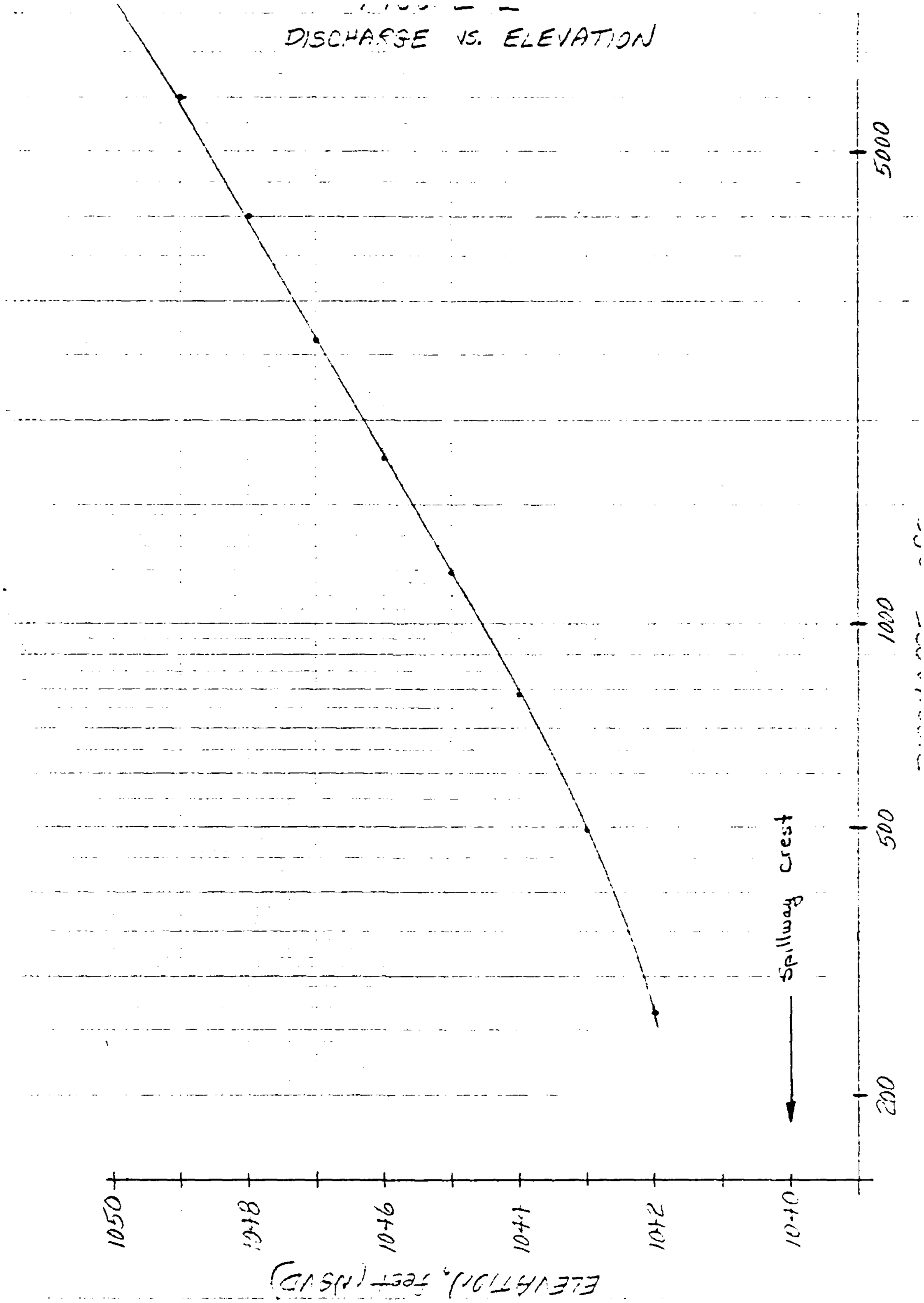
PROJECT [illegible] Pond Dam　　COMPTD. BY KMS　　DATE [illegible]

DETAIL [illegible] Calcs　　CK'D. BY BWP　　DATE 5/5/8[illegible]

8. Total Discharge – Summarized Graphically in Figure

Elevation, feet (NGVD)	Spillway Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Total [illegible]
1040.0	0	0	0	0	0	0	0
1041.0	33						33
1042.0	265						[illegible]
1043.0	495			0			[illegible]
1044.0	730	0		7		0	[illegible]
1045.0	[illegible]20	3	0	52	0	14	[illegible]
1046.0	1430	16	5	153	10	31	175[illegible]
1047.0	1900	45	39	543	46	247	262[illegible]
1048.0	2320	33	103	632	125	724	40[illegible]
1049.0	2770	175	247	936	225	1597	[illegible]
1050.0	3250	237	386	1310	364	2703	932[illegible]

DISCHARGE VS. ELEVATION



PROJECT Kilburn Pond Dam COMPTD. BY [illegible] DATE [illegible]
DETAIL Hydrologic Calcs CK'D. BY KMS DATE 5/5/

B. Effect of surcharge storage on max. prob. discharge

1. Pertinent Data

   a. Drainage area = 1.65 square miles
   b. Characteristics of basin - mountainous, but use to [illegible] account for [illegible] Pond + [illegible] swampy areas in drainage
   c. Test flood = 1/2 PMF
   d. Follow Army Corps' procedure

2. STEP 1: Determine Peak Inflow Q_{P1} from Guide Curve

   a. the maximum probable discharge was estimated to be 2,200 cfs/sq.mi

$$\therefore \text{PMF} = (2{,}200 \text{ cfs/sq.mi.})(1.65 \text{ sq.miles})$$

$$= 3{,}630 \text{ cfs}$$

$$1/2 \text{ PMF} \approx 1{,}820 \text{ cfs}$$

3. STEP 2: Determine surcharge height to pass Q_{P1}, $STOP_1$, and Q_{P2}

   a. from Figure 1 determine surcharge height to pass Q_{P1} =

surcharge elevation = 104
elev. spillway crest = 104

surcharge height

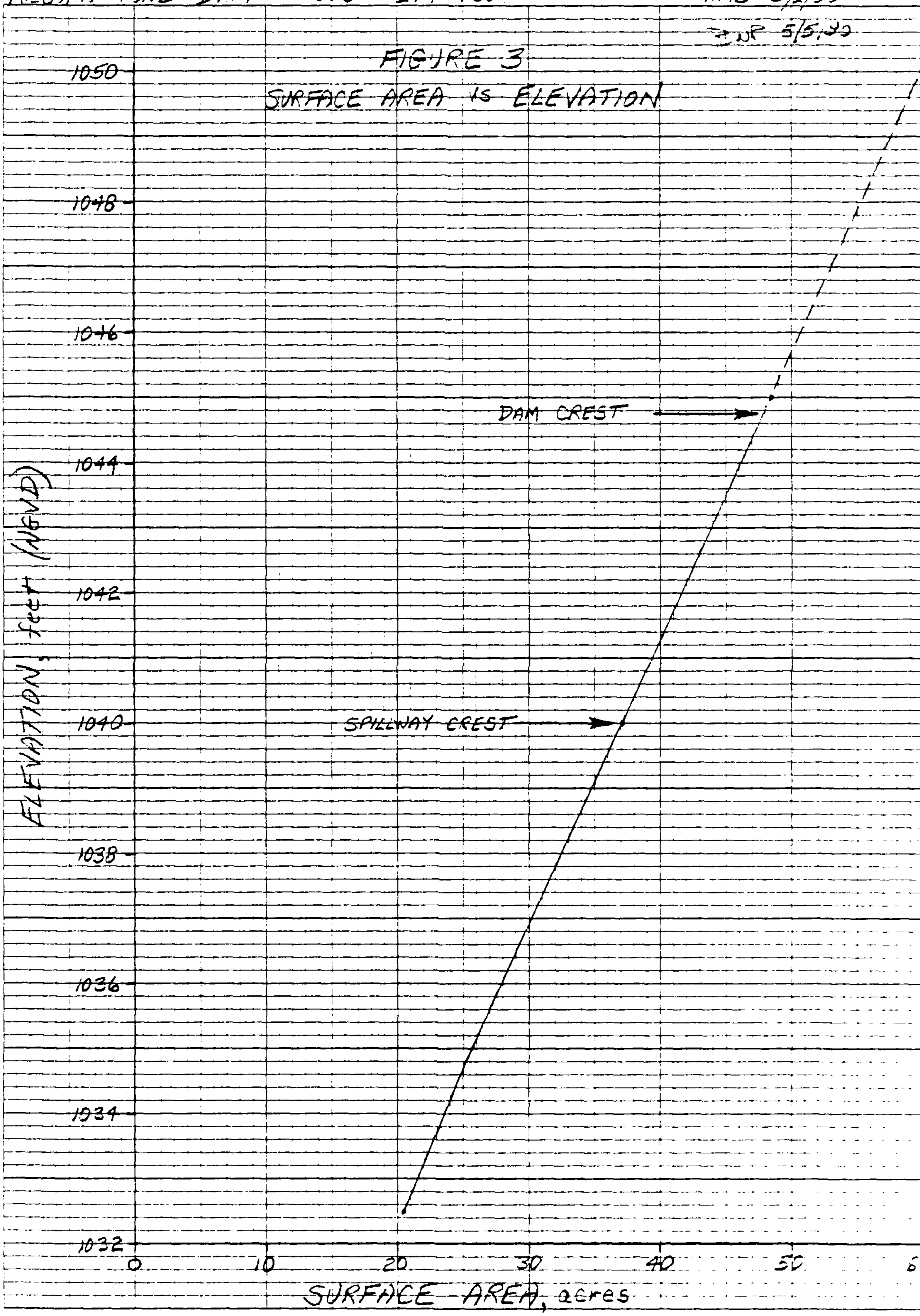
   b. determine volume of surcharge $STOP_1$ in inches of runoff

(1) determine storage in acre-feet in the manner

(a) determine surface of pond at surcharge [illegible] from Figure 2 ≈ 50.5 acres

(b) determine average surface [illegible] between crest pool and surcharge pool

KILBURN POND DAM JOB # 274-790 KMS 5/2/80 ENP 5/5/80



(c) multiply average surface area by surcharge height, for inclusion in the following equation

$$STOR_1 = \frac{\text{Volume of storage (as acre-inches)}}{\text{drainage area}}$$

$$STOR_1 = \frac{\left(\frac{37.07 \text{ acres} + 50.5 \text{ acres}}{2}\right)(6.0 \text{ ft})(12''/\text{ft})}{(1.65 \text{ sq.mi})(640 \text{ acres/sq.mi})}$$

$$STOR_1 = 2.99 \text{ inches}$$

c. determine Q_{P2}

$$Q_{P2} = Q_{P1}\left(1 - \frac{STOR_1}{9.5''}\right)$$

$$Q_{P2} = (1{,}820 \text{ cfs})\left(1 - \frac{2.99''}{9.5''}\right)$$

$$Q_{P2} \approx 1{,}250 \text{ cfs}$$

4. STEP 3: Determine surcharge height and [illegible] to pass Q_{P2} and then Q_{P3}

a. From Figure 1 determine surcharge height to pass Q_{P2} = 1,250 cfs

surcharge elevation ≈ 1045.1'
elev. spillway crest = 1040.0

Surcharge height = 5.1 [illegible]

[illegible] at surcharge elevation ≈ 49.5 [illegible]

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DETAIL Hydrologic Calcs. — CK'D. BY KMS — DATE [illegible]

b. determine $STOR_2$

$$STOR_2 = \frac{\left(\frac{37.07 \text{ acres} + 48.5 \text{ acres}}{2}\right)(5.0 \text{ ft})(12''/\text{ft})}{(1.65 \text{ sq. mi})(640 \text{ acres/sq. mi})}$$

$$= 2.48 \text{ inches}$$

c. Average $STOR_1$ and $STOR_2$

$$STOR_{AVG} = \frac{STOR_1 + STOR_2}{2}$$

$$STOR_{AVG} = \frac{2.99 \text{ in} + 2.48 \text{ in}}{2}$$

$$STOR_{AVG} = 2.73 \text{ inches}$$

d. determine Q_{P3}

$$Q_{P3} = (1{,}820 \text{ cfs})\left(1 - \frac{2.73''}{9.5''}\right)$$

$$Q_{P3} \approx 1{,}300 \text{ cfs}$$

5. STEP 4: Determine surcharge height for Q_{P3} and $STOR_3$

a. from Figure 1 surcharge height for Q_{P3} = 1,300 cfs

Surcharge elevation ≈ 1045.2'
elev. sp. way crest = 1040.0'
Surcharge height = 5.2 feet

surface area at surcharge elevation ≈ 49.0 acres

b. determine $STOR_3$

$$STOR_3 = \frac{\left(\frac{37.07 \text{ ac} + 49.0 \text{ ac}}{2}\right)(5.2 \text{ ft})(12''/\text{ft})}{(1.65 \text{ sq. mi})(640 \text{ acres/sq. mi})}$$

$STOR_3$ = 2.54 inches

c. determine $STOR_{AVG}$

$$STOR_{AVG} = \frac{2.73 \text{ in.} + 2.54 \text{ in.}}{2}$$

$STOR_{AVG}$ = 2.63 inches

d. determine Q_{P4}

$$Q_{P4} = (1,920 \text{ cfs})\left(1 - \frac{2.63''}{9.5''}\right)$$

Q_{P4} = 1,320 cfs

6. STEP 5: Determine surcharge height for Q_{P4} and $STOR_4$

a. From Figure 1 surcharge height for Q_{P4} = 1,320 cfs

surcharge elevation ≈ 1045.2'
elev. spillway crest = 1040.0'
surcharge height = 5.2 feet

Surface area at surcharge elevation ≈ 49.0 acre

b. determine $STOR_4$

$$STOR_4 = \frac{\left(\frac{37.07 \text{ ac} + 49.0 \text{ ac}}{2}\right)(5.2 \text{ ft})(12''/\text{ft})}{(1.65 \text{ sq.mi})(640 \text{ ac/sq mi})}$$

$STOR_4$ = 2.54 inches

c. determine $STOR_{AVG}$

$$STOR_{AVG} = \frac{2.63 \text{ in} + 2.54 \text{ in}}{2}$$

= 2.59 inches

$STOR_4$ and $STOR_{AVG}$ agree to within 2%
Therefore accept routed test flood discharge equal to 1,320 cfs at surcharge elevation equal to 1045.2 feet.

7. In Conclusion

a. Routed test flood discharge = 1,320 cfs will overtop the dam by ≈ 0.5 feet

b. Spillway Capacity

(1) water surface at dam crest - elevation = 1044.75'

$$Q = (3.3)(26\text{ ft})(1044.75' - 1040.0')^{3/2} \approx 1{,}020\text{ cfs}$$

(2) water surface at test flood elevation = 1045.2'

$$Q = (3.35)(26\text{ ft})(1045.2 - 1040.0)^{3/2} \approx 1{,}190\text{ cfs}$$

c. Sluicegate (flapgate) Capacity - discharge will be controlled by 6" and 18" sluice gates

(1) use orifice discharge equation $Q = Ca\sqrt{2gh}$ (Standard Handbook for CE's, Merritt) and assume discharge over spillway does not affect spillway discharge

(2) water surface at dam crest - elev = 1044.75'

$$Q = (0.6)\left[(0.25)^2\pi\right]\left[(2)(32.2)(1044.75' - 1033.75')\right]^{1/2} +$$
$$+ (0.6)\left[(0.75)^2\pi\right]\left[(2)(32.2)(1044.75' - 1031.75')\right]^{1/2} \approx 34\text{ cfs}$$

(3) water surface at test flood elevation = 1045.2 ft

$$Q = (0.6)\left[(0.25)^2\pi\right]\left[(2)(32.2)(1045.2' - 1033.75')\right]^{1/2} +$$
$$+ (0.6)\left[(0.75)^2\pi\right]\left[(2)(32.2)(1045.2' - 1031.75')\right]^{1/2} \approx 35\text{ cfs}$$

III. Using "Rule of Thumb" Guidance for Estimating Downstream Failure Hydrographs Examine Impact of Dam Failure

A. Since spillway length is large compared to length of dam, the tailwater resulting from discharge over the spillway with the water surface at the crest of dam may be significant

1. from previous calcs. steady state discharge over spillway with water surface at crest of dam ≈ 1,020 cfs (see p D-14 of Hydrologic Calcs)

2 Using Stage-Discharge curves prepared for routing of failure discharge determine stage for steady stage discharge in each reach (see Figure 4)
   a. Reach 1 - ≈ 3.4 feet
   b. Reach 2 - ≈ 2.7 feet
   c. Reach 3 - ≈ 3.0 feet
   d. Reach 4 - ≈ 3.5 feet
   e Reach 5 - ≈ 8.4 feet

3. The failure discharge should now be computed and routed through the stream reaches using the "Rule of Thumb" Guidance for Estimating Downstream Failure Hydrographs. This failure discharge should be routed on top of the steady state discharge. If the hazard is significantly increased by the failure discharge then the hazard classification will be defined by this routing procedure. If there is no significant increase in hazard over the steady state discharge, then the hazard classification shall be determined by failing the dam at the spillway crest.

B. Reach 1

1. STEP 1: Determine reservoir storage at time of failure

from previous calcs. storage = 461 acre-feet

2. STEP 2: Determine Peak Failure Outflow Q_{P1}

a. $Q_{P1} = (8/27)\ W_b\ \sqrt{g}\ Y_o^{3/2}$

where: W_b = Breach width (use 40% of total length)
$= (0.4)(33 \text{ feet})$ ≈ 33 feet between outcroppings
$= 13.2$ feet

Y_o = Total height from channel bed to pool level at failure
Assume failure occurs at gate house end of dam, consequently Y_o will vary due to variable level of channel bottom

$Y_{o_1} = 1044.75' - 1029.5' = 15.25$ ft for 6 ft
$Y_{o_2} = 1044.75' - 1030.75' = 14.0$ ft for 5 ft
$Y_{o_3} = 1044.75' - 1032.5' = 12.25$ ft for 2.2 ft

$$Q_{P1} = (8/27)(32.2)^{1/2}\left[(6\text{ ft})(15.25\text{ ft})^{3/2} + (5\text{ ft})(14.0)^{3/2} + (2.2\text{ ft})(12.25\text{ ft})^{3/2}\right]$$

$Q_{P1} \approx 1,200$ cfs

b. Since the discharge over the unfailed portion of the spillway is significant this discharge must be added to the failure discharge

$$Q_{P_{spillway}} = (3.3)(18.8\,\text{feet})(4.75)^{3/2} \approx 740\,\text{cfs}$$

c $Q_{P1(TOTAL)}$ = 1,200 cfs + 740 cfs = 1,940 cfs

3. Prepare stage discharge curve for Reach 1
   a. Pertinent Data
      (1) Reach length = 2,300 feet
      (2) Channel slope ≈ 0.056
      (3) Manning n = 0.05
      (4) Channel shape = trapezoidal
      (5) Base width ≈ 10 feet
   b. See Figure 4 for stage - discharge curve

4. Estimate Reach Outflow

   a. Determine stage for Q_{P1} = 1,940 cfs from Figure 4 and find volume in reach
      (1) Stage (depth of flow) ≈ 2.1 feet above pre-failure discharge (Total stage = 5.5 feet)
      (2) Volume in reach = (reach length)(cross-sectional area of channel)

$$X\text{-area} = (0.5)(2.1\,\text{ft})(40\,\text{ft} + 60\,\text{ft}) \approx 105\,\text{ft}^2$$

$$\text{Volume} = V_1 = \frac{(105\,\text{ft}^2)(2300\,\text{ft})}{43{,}560\,\text{ft}^2/\text{acre}} \approx 5.5\,\text{acre-ft}$$

$V_1 < \frac{S}{2}$ ∴ reach length OK

   b. Determine Q_{P2}

$$Q_{P2(TRIAL)} = Q_P\left(1 - \frac{V_1}{S}\right)$$

$$Q_{P2(TRIAL)} = (1,940\,\text{cfs})\left(1 - \frac{5.5\,\text{acre-ft}}{[illegible]}\right)$$

$$Q_{P2(TRIAL)} = 1{,}920\,\text{cfs}$$

c. Compute V_2 for Q_{P1} (TRIAL)

From Figure 4 determine stage for Q_{P1} (TRIAL)

Stage = 2.1 feet (Total stage = 5.5 feet)
above prefailure discharge

X-area = (0.5)(2.1 ft)(40 ft + 60 ft)
= 105 ft²

$$V_2 = \frac{(105\ ft^2)(2300\ ft)}{43{,}560\ ft^2/acre}$$

V_2 = 5.5 acre-ft

d. Average V_1 and V_2 and compute Q_{P2}

(1) $V_{avg} = \frac{V_1 + V_2}{2}$

$$V_{avg} = \frac{5.5\ ac\text{-}ft + 5.5\ ac\text{-}ft}{2}$$

V_{avg} = 5.5 acre-ft

(2) $Q_{P2} = Q_{P1}\left(1 - \frac{V_{avg}}{S}\right)$

$$Q_{P2} = (1{,}940\ cfs)\left(1 - \frac{5.5}{461}\right)$$

Q_{P2} = 1,920 cfs

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DATE 5/9/80
CKD BY
DATE

B. Reach 2

1. STEP 3: Prepare st[illegible] scharge [illegible] Reach

a. Pertinent Data

(1) Reach length = 3,600 feet

(2) Channel slope ≈ 0.0056

(3) Manning n = 0.05

(4) Channel shape - trapezoidal

(5) Base width ≈ 20 feet

b. See Figure 4 for stage- [illegible] curve

2. STEP 4: Estimate Reach Outflow

a. Determine stage for Q_{P2} = 1,920 cfs from Figure 4 and find volume in [illegible]

(1) Stage (depth of [illegible]) = 1.7 feet above prefailure discharge (Total Stage = 4.4 ft)

(2) Volume in reach = ([illegible]) (cross-sectional area of channel)

$$\text{X-area} = (0.5)(1.7\text{ ft})(240\text{ ft} + 365\text{ ft})$$
$$= 514\text{ ft}^2$$

$$\text{Volume} = V_1 = \frac{(514\text{ ft}^2)(3{,}600\text{ ft})}{43{,}560\text{ ft}^2/\text{acre}}$$

$$= 42.5\text{ acre-ft}$$

[illegible]

b. Determine $Q_{P3(T[illegible]}$

$Q_{P3(T[illegible]}$ [illegible]

$Q_{P3(T[illegible]}$ =

$Q_{P3(TRIAL}$ =

c. Compute V_2 using $Q_{P3(TRIAL)}$

From Figure 4 determine stage for $Q_{P3(TRIAL)}$

Stage = 1.5 feet (Total Stage = 4.2 feet)
above prefailure discharge

X-area = (0.5)(1.5 ft)(240 ft + 350 ft)
$\approx$ 443 ft^2

$$V_2 = \frac{(443\ ft^2)(3{,}600\ ft)}{43{,}560\ ft^2/acre}$$

V_2 = 36.6 acre-ft

d. Average V_1 and V_2 and compute Q_{P3}

(1) $V_{avg} = \frac{V_1 + V_2}{2}$

$$V_{avg} = \frac{42.5\ ac\text{-}ft + 36.6\ ac\text{-}ft}{2}$$

V_{avg} = 39.5 acre-feet

(2) $Q_{P3} = Q_{P2}\left(1 - \frac{V_{avg}}{S}\right)$

$$Q_{P3} = (1{,}920\ cfs)\left(1 - \frac{39.5}{461}\right)$$

Q_{P3} = 1,750 cfs

C. Reach 3

1. STEP 3: Prepare sta[illegible]-discharge [illegible] for Rea[illegible]

a. Pertinent Data

(1) Reach length = 3,500 feet
(2) Channel slope = 0.094
(3) Manning n = 0.05
(4) Channel shape - trapezoidal
(5) Base width ≈ 10 feet

b. See Figure 4 for [illegible]-discharge curve

2. STEP 4: Estimate Reach Outflow

a. Determine stage for Q_{p3} = 1,750 cfs from [illegible] and find volume in reach

(1) Stage (depth [illegible]) ≈ 1.8 feet
above prefailure discharge

(2) Volume in reach = (reach length) (cross-sectional area)

$$\text{X-area} = (0.5)(1.8\ \text{ft})(37\ \text{ft} + [illegible]) \approx 82\ \text{ft}^2$$

$$\text{Volume} = V_1 = \frac{(82\ \text{ft}^2)(3500\ \text{ft})}{43{,}560\ \text{ft}^2/\text{acre}}$$

$$= 6.6\ \text{acre-feet}$$

$V_1 < \frac{S}{2}$ ∴ reach length [illegible]

b. Determine $Q_{p4(TRIAL)}$

$$Q_{p4(TRIAL)} = Q_{p3}\left(1 - \frac{V_1}{S}\right)$$

$$Q_{p4(TRIAL)} = (1{,}750\ \text{cfs})(1 - [illegible]$$

$$Q_{p4\,(TRIAL)} = 1{,}720\ \text{cfs}$$

c. Compute V_2 using $Q_{P4(T)}$ ...

From Figure 4 determine stage for $Q_{P4(}$

Stage ≈ 1.3 feet (Tota
above prefailure discharge

X-area = (0.5)(1.3 ...)(37... -

≈ 82 ft^2

$$V_2 = \frac{(82\ ft^2)(3{,}500\ ft)}{43{,}560\ ft^2/acre}$$

V_2 = 6.6 acre-feet

d. Average V_1 and V_2 and compute Q_{P4}

(1) $V_{avg} = \frac{V_1 + V_2}{2}$

$$V_{avg} = \frac{6.6\ ac\text{-}ft + 6.6\ ac\text{-}ft}{2}$$

V_{avg} = 6.6 acre-feet

(2) $Q_{P4} = Q_{P3}\left(1 - \frac{V_{avg}}{S}\right)$

$$Q_{P4} = (1{,}750\ cfs)\left(1 - \frac{6.6}{461}\right)$$

Q_{P4} = 1,720 cfs

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DETAIL [illegible]	CK'D. BY AMS	DATE [illegible]	

D. Reach 4

1. STEP 3: Prepare stage-discharge curve for Reach

a. Pertinent Data.

(1) A small dam is located at the end of the reach, approximately 300-feet upstream from Route 63 culvert. The dam is approximately 140 feet long, with a 43 feet long by 4 feet deep [illegible] shaped weir spillway. The dam impounds a small pond with a surface area of approx. 15,000 sq.ft. In the past water was withdrawn from this impoundment and passed through filtration plant located just below the dam. [illegible] filtration plant has been abandoned and no [illegible] supplies water to the town of Hinsdale. [illegible] all water entering this impoundment [illegible] spillway to the continuation of [illegible] Brook.

(2) See Figure 4 for the stage-discharge curve

2. STEP 4: Estimate Reach Outflow

a. Determine stage for Q_{P4} = 1,720 [illegible] and find volume in reach

(1) Stage ≈ 2.2 feet (Total Stage = [illegible]
above prefailure discharge

(2) Volume in reach = (Stage)(surface area [illegible])

$$\text{Volume} = V_1 = \frac{(2.2\ ft)(15,000\ ft^2)}{43,560\ ft^2/acre}$$

$$V_1 \approx 0.8 \text{ acre-feet}$$

b. Determine $Q_{P5(TRIAL)}$

$$Q_{P5\,(TRIAL)} = Q_{P4}\left(1 - \frac{V_1}{S}\right)$$

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DETAIL [illegible] Calcs	CK'D. BY [illegible]	DATE	[illegible]

$$Q_{P5(TRIAL)} = (1,720\ cfs)\left(1 - \frac{0.8}{461}\right)$$

$$Q_{P5(TRIAL)} = 1,720\ cfs$$

c. Compute V_2 using $Q_{P5(TRIAL)}$

From Figure 4 determine stage for $Q_{P5(TRIAL)}$

Stage ≈ 2.2 feet (Total Stage = 5.7 ft)
above prefailure discharge

$$V_2 = \frac{(2.2\ feet)(15,000\ ft^2)}{43,560\ ft^2/acre}$$

$$V_2 = 0.8\ acre-feet$$

d. Average V_1 and V_2 and compute Q_{P5}

(1) $$V_{avg} = \frac{V_1 + V_2}{2}$$

$$V_{avg} = \frac{0.8\ ac\text{-}ft + 0.8\ ac\text{-}ft}{2}$$

$$V_{avg} = 0.8\ acre-feet$$

(2) $$Q_{P5} = Q_{P4}\left(1 - \frac{V_{avg}}{S}\right)$$

$$Q_{P5} = (1,720\ cfs)\left(1 - \frac{0.8}{461}\right)$$

$$Q_{P5} = 1,720\ cfs$$

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DETAIL Hydrologic Calcs.　　CK'D BY [illegible]　　DATE [illegible]

E. Reach 5

1. STEP 3: Prepare stage-discharge curve for Reach 5

a. Pertinent Data

Discharge through reach controlled by culvert beneath Rte 63 and roadway profile. Information pertaining to culvert and roadway profile is included in Section V of the Hydrologic Calcs. Reach length equals 300 feet.

b. See Figure 6 in Section V of the Hydrologic Calcs for elevation-discharge curve

2. STEP 4: Estimate Reach Outflow

a. Determine stage for $Q_{P5} = 1{,}720$ cfs from Figure 6 and find volume in reach

(1) Stage (depth of flow) = 2.6 feet above prefailure discharge　　(Total Stage = 11.0 ft)

(2) Volume in reach = (reach length) (cross-sectional area of channel)

$$\text{X-area} = (0.5)(2.6\text{ ft})(15\text{ ft} + 380\text{ ft})$$
$$= 514\text{ ft}^2$$

$$\text{Volume} = V_1 = \frac{(514\text{ ft}^2)(300\text{ ft})}{43{,}560\text{ ft}^2/\text{acre}}$$

$$= 3.5 \text{ acre-feet}$$

$V_1 < \frac{S}{2}$ ∴ reach length OK

b. Determine $Q_{P6(TRIAL)}$

$$Q_{P6(TRIAL)} = Q_{P5}\left(1 - \frac{V_1}{S}\right)$$

$$Q_{P6(TRIAL)} = (1{,}720\text{ cfs})\left(1 - \frac{3.5}{461}\right)$$

$$Q_{P6(TRIAL)} = 1{,}710 \text{ cfs}$$

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DETAIL	Hydrologic Calcs	CK'D. BY	[illegible]	DATE	[illegible]

c. Compute V_2 using $Q_{P6(TRIAL)}$

From Figure 6 determine stage for $Q_{P6(TRIAL)}$

Stage = 2.6 feet above prefailure discharge (Total stage = 11.0 ft)

$$X\text{-area} = (0.5)(2.6\ ft)(15\ ft + 380\ ft)$$

$$\approx 514\ ft^2$$

$$V_2 = \frac{(514\ ft^2)(300\ ft)}{43{,}560\ ft^2/acre}$$

$$V_2 = 3.5\ \text{acre-feet}$$

d. Average V_1 and V_2 and compute Q_{P6}

(1) $$Vavg = \frac{V_1 + V_2}{2}$$

$$V_{avg} = \frac{3.5\ a\text{-}ft + 3.5\ a\text{-}ft}{2}$$

$$Vavg = 3.5\ \text{acre-feet}$$

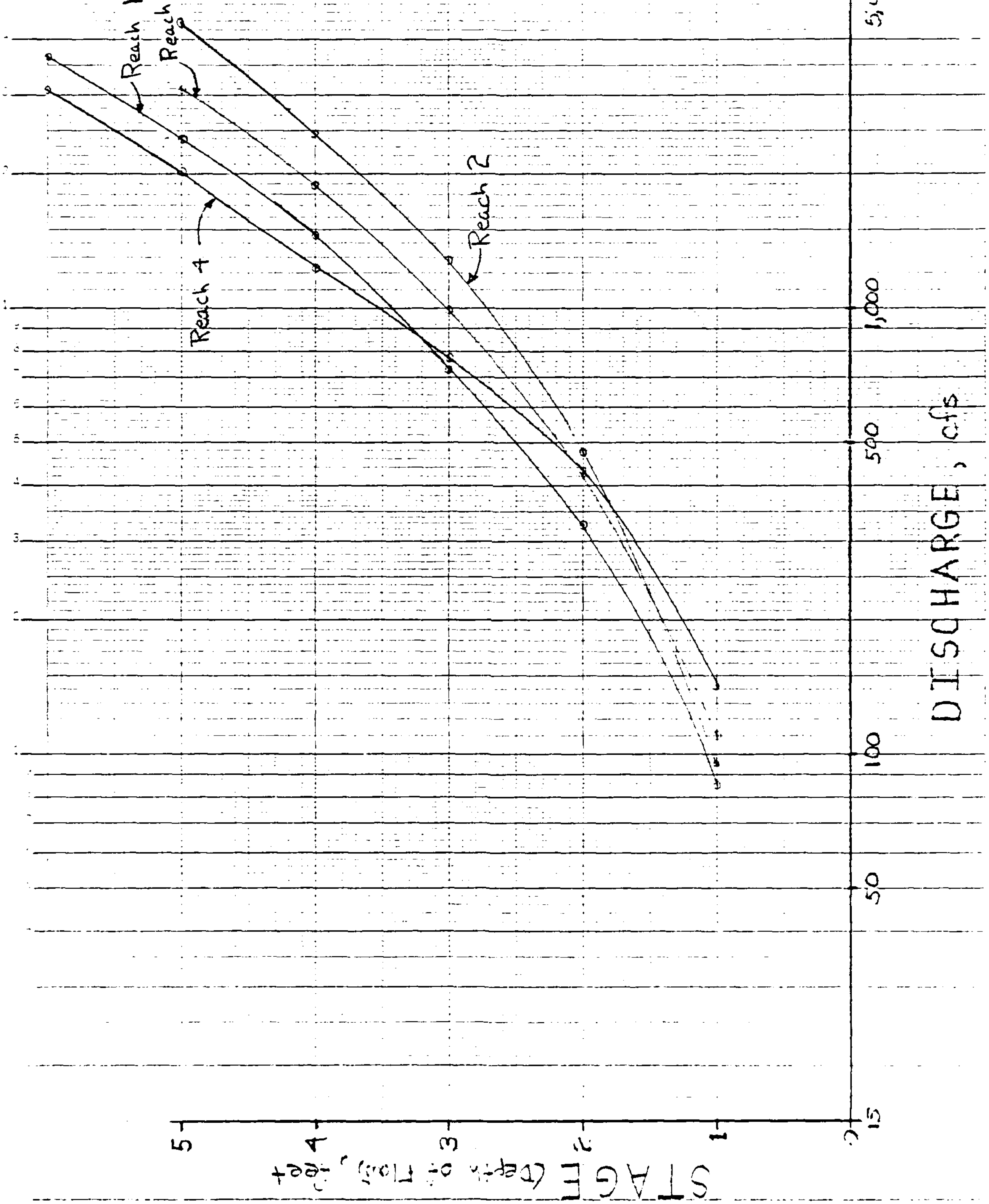
(2) $$Q_{P6} = Q_{P5}\left(1 - \frac{Vavg}{S}\right)$$

$$Q_{P6} = (1{,}720\ cfs)\left(1 - \frac{3.5}{461}\right)$$

$$Q_{P6} = 1{,}710\ cfs$$

FIGURE 4

DISCHARGE vs STAGE



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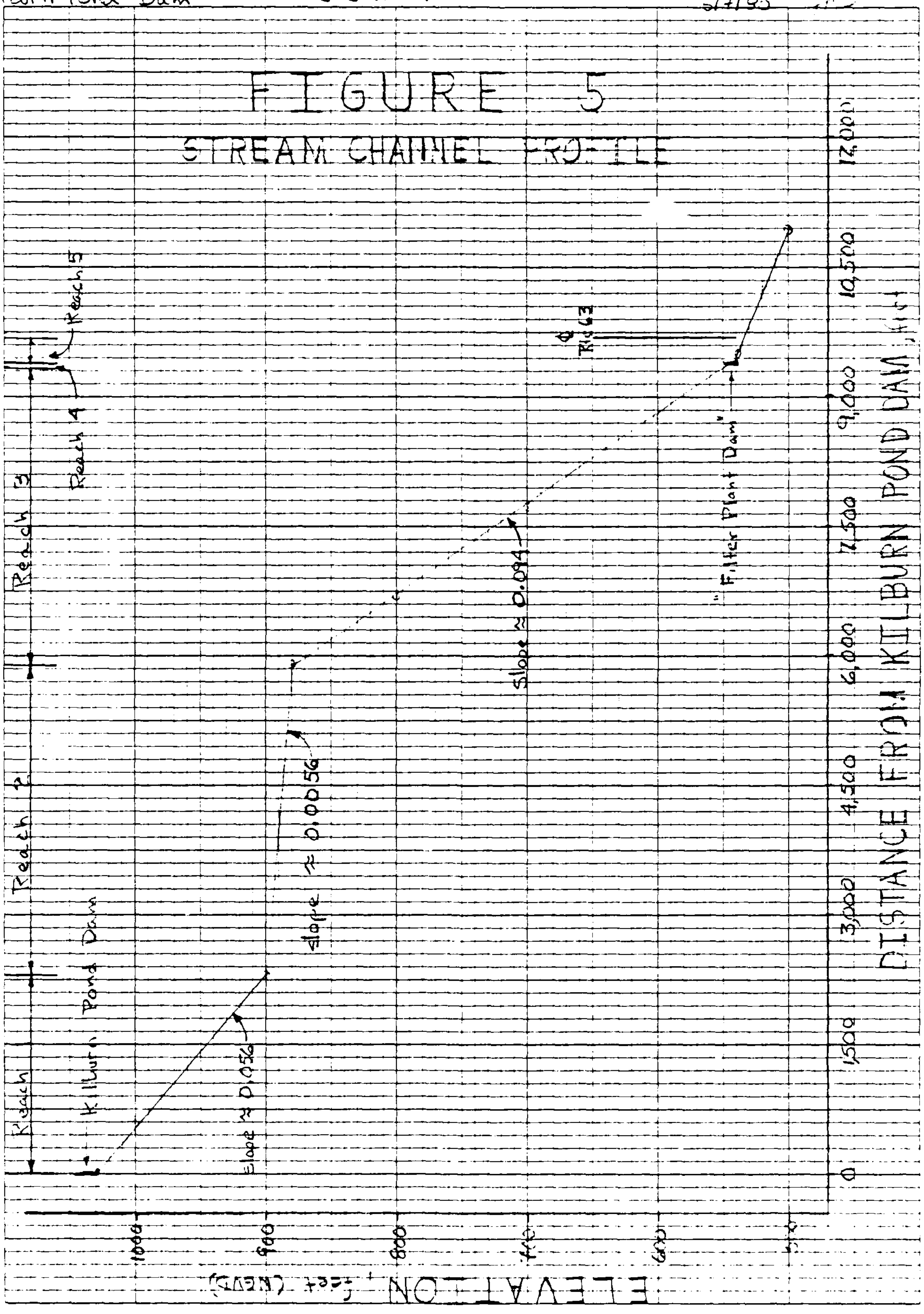


F. Conclusions resulting from analysis of failure of dam with water surface at dam crest

1. The two major points of interest are Reaches 4 and 5

2. Reach 4 - The routed failure discharge would significantly increase the hazard over the prefailure discharge. The prefailure discharge would not overtop the dam in Reach 4; however the failure discharge would cause the dam to be overtopped by about 1.7 feet

3. Reach 5 - The routed failure discharge would significantly increase the hazard over the prefailure discharge. It appears that the culvert beneath Route 63 has adequate capacity to handle the prefailure discharge; however, the failure discharge would cause the roadway to be overtopped by about 2.5 feet. Furthermore, water would rise to nearly a foot above the sill of the house located adjacent to Route 63

V Discharge at Route 63 culvert

A. Discharge through culvert (flowing full)

1. Pertinent Data

a use Manning Equation to determine culvert discharge

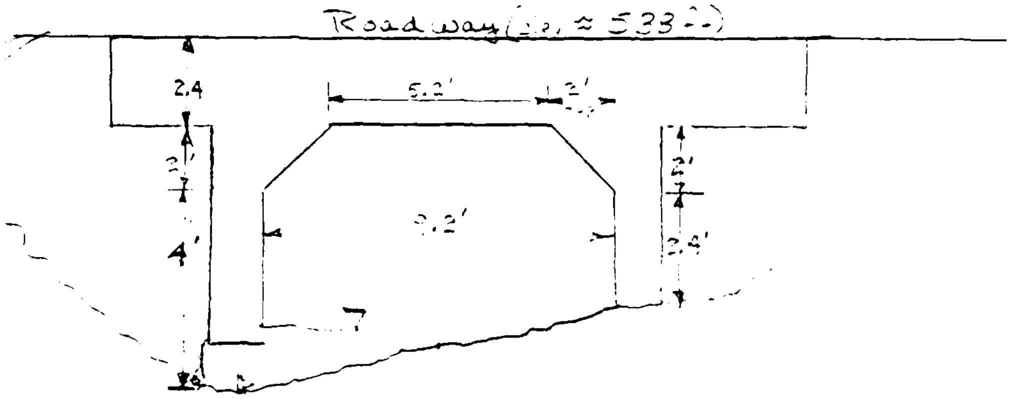
$$Q = A \frac{1.486}{n} R^{2/3} S^{1/2}$$

where: Q = discharge, cfs
A = cross-sectional area of culvert, ft²
n = Manning roughness coef.
R = hydraulic radius
S = culvert slope

b culvert data

(1) cast-in-place side walls and roof with natural stream channel bottom

(2) dimensions



(3) length of culvert = 31 feet

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2. determine capacity of culvert flowing full

(1) pertinent data
(a) cross-sectional area ≈ 43.8 ft²
(b) weighted n ≈ 0.025 (from natural stream channel n = 0.05 and concrete n = 0.015)
(c) slope = 0.0032

(2) $$Q_{full} = (43.8\ ft^2)\left(\frac{1.486}{0.025}\right)\left(\frac{43.8\ ft^2}{26.6\ ft}\right)^{2/3}(0.0032)^{1/2}$$

$Q_{full} \approx 205$ cfs

water surface at elevation ≈ 535.6 ft

B. Discharge through culvert with submerged crown

1. Pertinent data

use culvert head loss equation solved for Q

$$Q = \left(\frac{2g\ R^{1.33}\ A^2\ H}{29\ n^2\ L}\right)^{1/2}$$

$g = 32.2$ ft/sec² | $A = 43.8$ ft² | $L = 31$ ft
$R = (43.8/26.6) = 1.65$ | $n = 0.025$ | H = head above crown of culvert

$$Q = \left[\frac{(2)(32.2)(1.65)^{1.33}(43.8\ ft^2)^2\ H}{(29)(0.025)^2\ (31\ ft)}\right]^{1/2}$$

$Q = 654\ H^{1/2}$

2. Elevation vs Discharge Table

Elevation (ft)	Constant	H (feet)	Q (cfs)
536	654	0.5	462
537	↓	1.5	801
538		2.5	1034
539		3.5	1220
540		4.5	1390
541		5.5	1530
542	↓	6.5	1670

C Discharge over roadway

1 Pertinent Data

a. use broad crested weir equation with C = 2.6

$$Q = C L H^{3/2}$$

b. Elevation vs Discharge Table

Elevation (ft)	C	L (ft)	Avg H (ft)	Q (cfs)
538	—	—	0	0
539	2.6	170	0.5	[illegible]
540	↓	350	1.0	[illegible]
541		410	.5	[illegible]
542	↓	430	2.0	3530

D. Total discharge vs elevation data summarized Figure 6

Kilburn Pond Dam

FIGURE

DISCHARGE vs ELEV

@ ROUTE 63 C

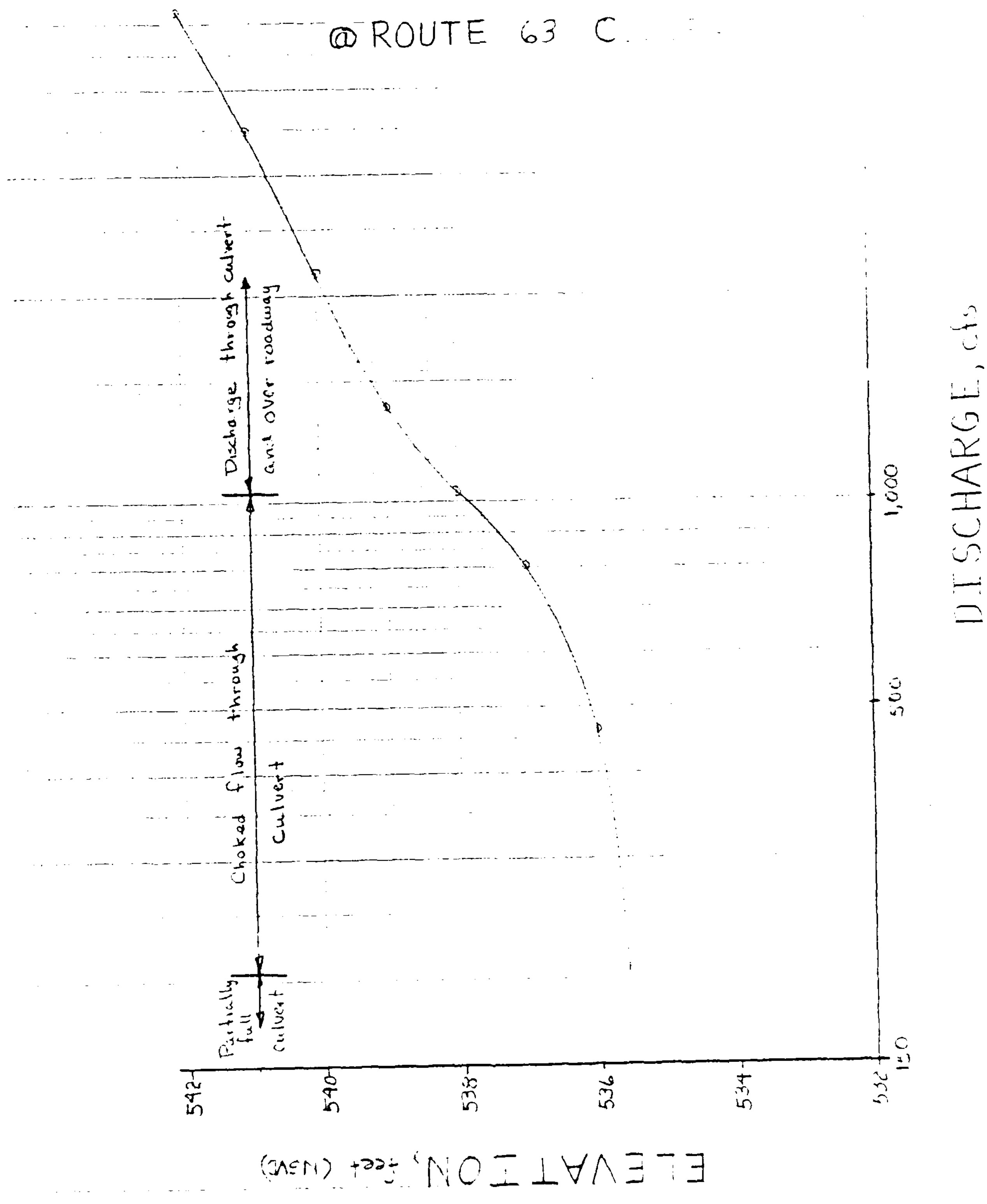
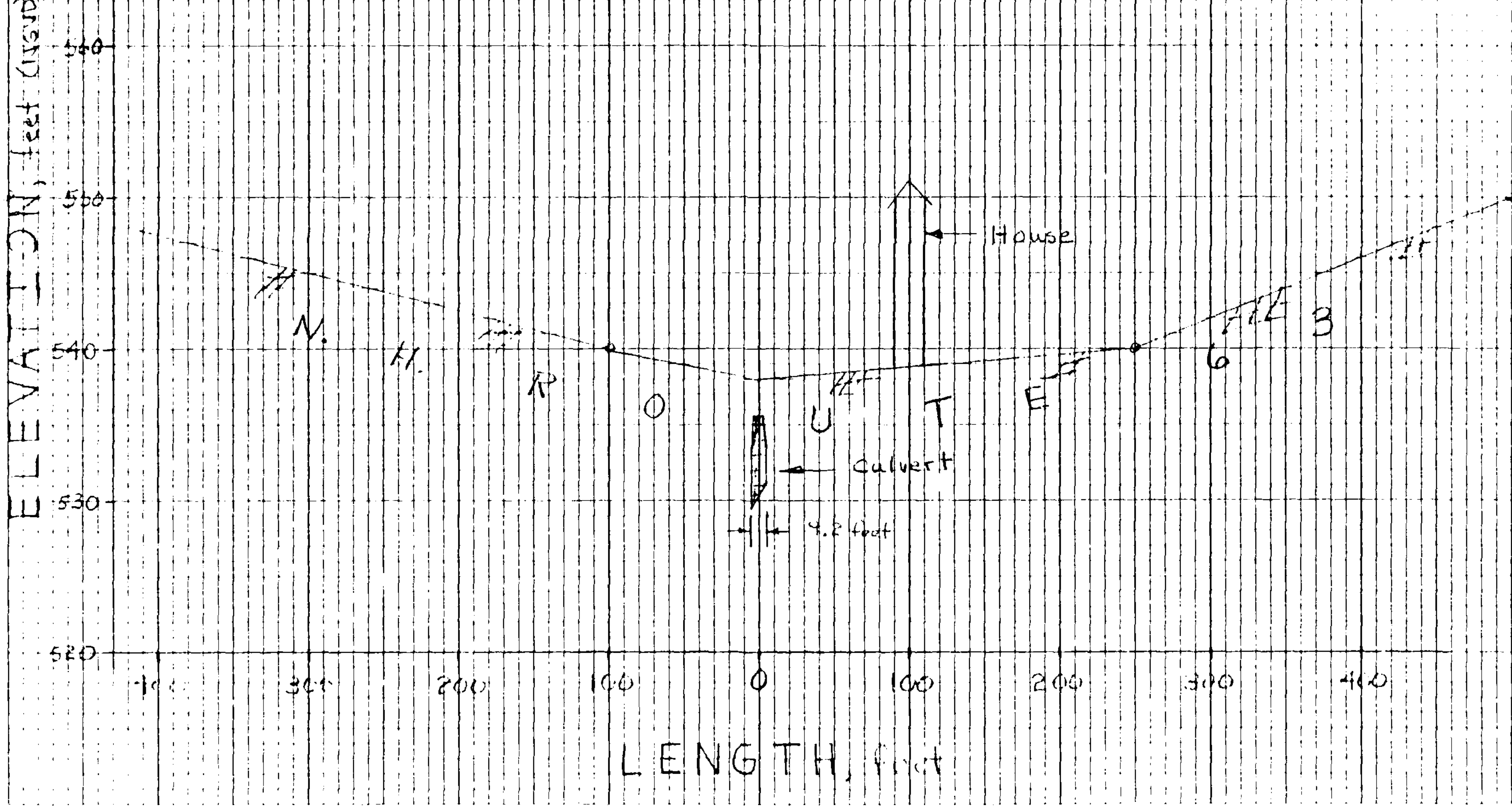


FIGURE 7

CHANNEL CROSS-SECTION
@ N.H. ROUTE 63
(view looking downstream)



AD-A156 435 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAM KILBURN POND DAM (NH 0..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV JUN 80 2/2

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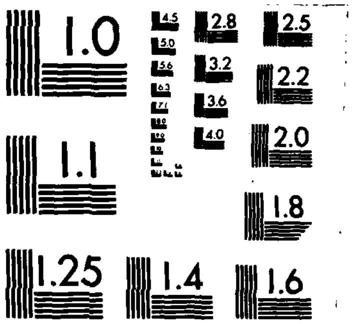

MICROCOPY RESOLUTION TEST CHART
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APPENDIX E

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR. DIST.	STATE	COUNTY	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
	298	NED	NH	005	02				KILBURN POND DAM	4249.5	7228.2	16JUN80

POPULAR NAME	NAME OF IMPOUNDMENT
	KILBURN POND

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	KILBURN BROOK	HINSDALE	3	3472

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
PGOT	1955	C	15	15	461	252	NED	N	N	N	N	

REMARKS
20-1977 STATE CENSUS 21-REINFORCED CONCRETE 23-ABANDONED WATER SUPPLY

D/S HAS	SPILLWAY CREST LENGTH	TYPE	WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	PROPOSED (MW)	NO.	NAVIGATION LOCKS LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	35	U	26	1020	125											

OWNER	ENGINEERING BY	CONSTRUCTION BY
TOWN OF HINSDALE	METCALF + EDDY	O A MILLER CO INC

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BOARD	NH WATER RES BOARD	NH WATER RES BOARD	NH WATER RES BOARD

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
SEA CONSULTANTS INC	06MAY80	PL 92-367

REMARKS

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